# Income Shocks and Investments in Human Capital*

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November 16, 2009
JOB MARKET PAPER

**Abstract**

This paper studies the link between income shocks and parental investments in children in time and goods. I create a unique panel data set of income, expenditures and time allocations, combining data on Children of the NLSY79 with the Consumer Expenditure Survey (CEX) and the American Time Use Survey (ATUS). Income shocks are instrumented by local business cycles, which are measured by an unpredictable component of the county unemployment rate. I study different responses to shocks by type of shock (positive or negative), structure of age of children in family and mothers' education. I find that when there are surprise increases in the local unemployment rate (1) there are little changes on expenditures in children's education, and (2) families substitute time spent in children's educational activities for leisure activities.

**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 Orazio Attanasio, James Banks, Samuel Berlinski, Richard Blundell, Andrew Chesher, Emanuela Galasso, Karthik Kalyanaraman, Guy Laroque, Costas Meghir, Lars Nesheim, Nicola Pavoni, Marcos Vera Hernandez and Jelmer Ypma and seminar participants at UCL. 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. 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[1], and substantial evidence on differences in the educational attainment of children from different socioeconomic backgrounds[2], there are virtually no studies on the effects of changes in income on parental investments in children[3]. One of the reasons for this gap in the literature is the lack of data sets that comprise 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[4]. 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 on consumption[5], 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

[1] See recent work by Blundell, Pistaferri and Preston, 2008, and papers they cite.

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

[3] 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.

[4] 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.

[5] 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.

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[6]. 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, 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[7] 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[8]. 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 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[9]. This method produces 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

[6]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.

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

[8]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.

[9]The method is based on the use of two data sets: (i) a primary data set where imperfect measures of investment in human capital are observed, (ii) an auxiliary data which contains both the imperfect and true measures of investments (see Chen, Hong and Tamer, 2005).

income residuals (see Blundell and Preston, 1998 and Blundell, Pistaferri and Preston, 2008). 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[10]. 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 positive 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) transmission of shocks to human capital only occurs if shock takes place before child turns 10 and in families of less educated mothers, and (ii) families of college of educated mothers rely on accumulated assets as buffer to shocks, whereas the no college group uses welfare income. 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. When 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,

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

substituting time in education by leisure with their children.[11] This reaction is driven by the group of families of no college educated mothers and it 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[12]).

The paper proceeds as follows. Section 2 presents the predictions of a life-cycle model augmented to allow for altruistic parents that invest in their children. Section 3 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 4 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 5 carries out several tests of formal tests of consumption insurance. Section 6 concludes.

# 2 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 numerary 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 child's cognitive skills including reading, helping with homework or attending school meetings.

The parent is altruistic and forward looking trying to anticipate the future outcomes of each period's $t$ decision, so that it only cares about child's total human capital when she reaches age $T$ and leaves the house with human capital $h_T$. There is no depreciation in child's human capital, and bequests must be nonnegative, so that $A_{T+1} \geqslant 0$. The child does not take any decision and parents investment decisions are based on altruism.

Parents utility in each period $t$, $u_P$, depends only on the consumption of period $t$, $c_t$, is separable across periods, and it depends on a vector of observable variables $\mathbf{z}_t$ and an unobservable variable

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

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

$\xi_t$. The parent's problem may be written as:

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

where $\beta$ is the discount rate, and $\varphi$ is the altruism parameter. $E_j [.]$ is the expectation operator and $I_j$ is the information set of the parent at time $j$.

In general, 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 child's human capital when she leaves 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 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 parents 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 $\lambda_t$ and $\mu_t$ as the multipliers on the budget and credit constraints, respectively. The first-order conditions of maximizing (1) subject to (2), (3) and (4) :

$$c \ : \ \beta^t \frac{\partial u_P \left( c_t, \mathbf{z}_t, \xi_t \right)}{\partial c_t} = \lambda_t \tag{5}$$

$$A \ : \ \lambda_t = E_t \left[ \lambda_{t+1} \left( 1 + r_{t+1} \right) + \mu_t \right] \tag{6}$$

$$g \ : \ \varphi E_t \left[ \frac{\partial u_C \left( h_T \right)}{\partial h_T} \frac{\partial f}{\partial g_t} \right] = \lambda_t q_t \tag{7}$$

$$i \ : \ \varphi E_t \left[ \frac{\partial u_C \left( h_T \right)}{\partial h_T} \frac{\partial f}{\partial i_t} \right] = \lambda_t w_t \tag{8}$$

where $\frac{\partial u_P (c_t, \mathbf{z}_t, \xi_t)}{\partial c_t}$ is the marginal utility parent derives from own consumption when child is $t$ years old, $\lambda_t$ is the marginal utility of wealth, and $\frac{\partial h_T}{\partial g_t}$ and $\frac{\partial h_T}{\partial i_t}$ are the marginal productivity of $g_t$ and

$i_t$, respectively. Clearly, 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 market.

Production function of human capital plays in this model a role similar to stock equations in models of consumption with durable goods and habit formation (see Attanasio, 1999). Complementarity of investments across periods is a feature of models of habit persistence[13] As in model with durable goods[14] services of investments in one period last for subsequent periods. This resembles 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, as marginal productivity of investment in each period of childhood is a function of past, present and future variables. Testing theoretical implications of such model impose extreme data requirements: at each period parents' decision depends on past investment decisions, materialized on child's current human capital, and future decisions, which will be materialized in child's total human capital, $h_T$. Additionally, the dynamics of child's accumulation of human capital is related with parents' consumption decision in each period $t$ through the marginal utility of wealth $\lambda_t$.

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

$$1 = E_t \left[ \frac{\frac{\partial u_C(h_T)}{\partial h_T} \frac{\partial f}{\partial g_{t+1}}}{\frac{\partial u_C(h_T)}{\partial h_T} \frac{\partial f}{\partial g_t}} \frac{q_t}{q_{t+1}} (1 + r_{t+1}) + \mu_t \right] \tag{9}$$

$$1 = E_t \left[ \frac{\frac{\partial u_C(h_T)}{\partial h_T} \frac{\partial f}{\partial i_{t+1}}}{\frac{\partial u_C(h_T)}{\partial h_T} \frac{\partial f}{\partial i_t}} \frac{w_t}{w_{t+1}} (1 + r_{t+1}) + \mu_t \right] \tag{10}$$

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

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

Without borrowing constraints, $\mu_t = 0$, and 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

[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.

$t+1$[15]. Condition $A_{T+1} \geqslant 0$ is biding if 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 consumption and investment goods is independent of (short-term) credit constraints (Meghir and Weber, 1996, Aiyagari, Greenwood and Seshadri, 2002). Parent equates expected marginal productivity of both types of investments:

$$E_t \left[ \frac{\frac{\partial f}{\partial g_t}}{\frac{\partial f}{\partial i_t}} \right] = \frac{q_t}{w_t}, \tag{12}$$

and investments in any period only depend on the relative price between any two goods and all investments done at any age. This is independent of the interest rate. Credit market imperfections will appear on intertemporal conditions: relative to intratemporal condition (12), Euler equations (9) and (10) depend on interest rate, specific price appreciation and are not robust to credit market imperfections.

I now describe briefly the implications on the investments patterns using a version of the above model solved for two periods, with on 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, $\rho$. The larger the complementarity (smaller $\rho$) of investments across periods the larger proportion of period 1's income, $y_1$, spent in 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 substitutes across periods, parents will spend a very small fraction of income $y_1$ in human capital. In both cases, parents smooth consumption across periods (see panel for parents consumption). Relative productivity of investments across periods $\theta_2$ 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 $y_1 < \frac{y_2}{1+r}$,. Parents are no longer able to smooth their consumption if 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 closer to substitutes. Constrained families with $\rho = -0.5$ invest a higher proportion of period's 1 income investment to compensate for low substitutability of investment across periods and children suffer more damages in their final human capita due to credit constraints.

[15]See Cunha and Heckman, 2007.

## 2.1 The technology of skill formation and excess sensitivity/smoothness to income shocks

If investments in children are complementary over time in the production function of human capital then they have characteristics of habit formation. They accumulate over time and parents smooth investment across periods. This behavior may induce excess smoothing of shocks if families face shocks early in child's life (when some investments might be critical) or if facing negative shocks. If investments are substitutes over time then one may expect some excess sensitivity in reaction to income shocks with parents postponing less sensitive investments to child's development and smooth nondurable consumption.

If investments are complementary over time and if family faces a negative shock in a critical period for some investments to be effective in future, then parents may smooth the effect of shock; on the contrary, if families faces a positive shock they may take advantage of it and increase the investment more proportionally than the change in income. Thus, child human capital functions like assets to transfer resources over time.

What about substitutability of investments within periods? Again here distinction between positive and negative shocks may be important. A labor market shock changes the relative price of time, therefore it 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; so, by income effect, both time and expenditure investment decrease; substitution effect implies a substitution of expenditures by time. Then, expenditures decrease and effect on time use depends on whether substitution or income effect dominates. However, (as I show in Section 3.1) for poorer families both investments in terms of time and goods are inferior goods, and so a decrease in wage is associated with an increase in expenditures and time with children (by income effect) and expenditures are substituted by time; the overall effect on time is expenditures is ambiguous, and poor parents spend more time with their children. Early years are critical for the return of future investments, so parents may react asymmetrical towards shocks and, in the example above, the effect of a negative shock on expenditures might be null in poorer families, whereas better off parents smooth the effect of shock on the use of time.

The degree of intratemporal substitution depends on three things. First, it depends on income elasticity of investments. Second, it depends on the degree of substitution/complementarity of goods per period in the production function of human capital. Third, it depends on child's age and expected returns from investment. This may explain a differential reaction of parents according to age structure of their children.

Parents expectations about a child are a specific form of credit constraints: if parents' predict high future earnings for a child, they will try to borrow against her income. However, these constraints are operative at child level and will determine reactions towards specific children within family (depending on each child's production function). Parents invest more on the child whose

expected returns are higher, the more complementary over time investments are and the younger the child. And what 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[16]. To properly take expectations into account one needs specific measures of investment in children instead of household level allocations. I will address this issue in future research.

# 3 The data

For the primary analysis, I use data on females of 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 infer about effects of income changes on the use of resources and time[17]. Second, being categorical they lack the natural interpretation of use financial resources and time which make families' constraints. Finally, one could use aggregated indexes of parenting variables available from the CNLSY, however, equations (9), (10) and (12) 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 differently 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)

[16]In the NLSY I do not observe transfers between parents and children. To test for this type of strategy one can test for excess smoothing on investment in child-specific investment when families face positive shock and excess sensitivity with negative shocks.

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

and America Time Use Survey (ATUS), respectively.

## 3.1 Descriptive analysis of the data

To keep the sample homogeneous across children's life-cycle I impose several restrictions when selecting the sample to be used. More details are provided in Appendix A. The sample used in the analysis excludes children (and their families) to whom there is no information on the county of residence and observations to which is not possible to infer about mother's marital status or family size.[18] 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 sample to be used 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).

Table 1 compares NLSY79, CEX and ATUS in terms of demographics and socio-economic characteristics for the years in each 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, the NLSY79's families have overall 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 white; when the entire period of 1980-2000 is pooled together the proportion of married women is larger in CEX than in NLSY79 and 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 three data sets, but women tend to overreport hours work both in CEX and NLSY79 when compared to the ATUS.[19]

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 number of hours worked by mothers increases with child's age and Figure 3b presents similar patterns for total family income[20].

Figures 4 and 5 provide descriptives of the shock used. Figures 4a shows the density of shock, Figure 4b presents yearly variation of shocks. The shock varies between unexpected decreases of 4% in unemployment and increases of 6%; Figure 4b shows yearly variation across counties since

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

[19]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.

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

1976 and 2006: the standard deviation of the shock is 1.8%, and inequality has been fairly stable since 1986. Figure 5 provides visual inspection of 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 presents a convex shape, increase steeply with large decreases in unemployment (via increase of private transfers) and increases smoothly with unemployment (via increase in public transfers).

To re-scale investment variables in the CNLSY I use auxiliary information available in CEX and ATUS; this procedure uses variation from CNLSY and it allows to reduce the number of measures of investment. Information is measured with error in the CNLSY - variables are categorical or dicothomic[21] - and CEX and ATUS contain both the information measured correctly (expenditures and minutes with children, respectively) and with error. The later data sets allow to recover the relationship between the true and mismeasured variables and this relation is used to re-scale mismeasured variables in the CNLSY. To re-scale investment variables I first aggregate child level variables for each family in the CNLSY because information in CEX and ATUS is available at household level; and then I recover family expenditure and time use by matching NLSY with CEX and ATUS. 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.

### 3.1.1 Evolution of consumption and time across child's life cycle

**Expenditures** I study how expenditures in child specific goods that are used to re-scale CNLSY's measures vary across child's life cycle when information is only observed in the CEX. As 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 measures of expenditures in education between 1983 and 2000. The measure of nondurable consumption is the same used in Blundell, Pistaferri and Preston, 2008[22]; expenditures in education include baby sitting, day care costs, elementary and high school tuition, school books, expenditures in magazines and newspapers and toys/hobbies. These last set of variables was chosen to be matched with child care and type school attendance indicators available in CNLSY[23] and indicators of purchase of magazines

[21] 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 spurious. For the following variables: number of books child 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 set of variables, although subject to measurement error, varies in expect direction.

[22] Nondurable consumption includes food (at home and away from home), alcohol, tobacco, services (heating fuel, public and private and private transports), personal care, clothing and footwear.

[23] 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.

and newspapers, number of books the child has and toys and hobbies encouraged by parents. Across years expenditures in education and non-durable consumption present a close co-movement and inequality in expenditures in education is five times larger then inequality in nondurable consumption[24].

Figure 6 presents mean and variance of expenditures by age of youngest child in household using CEX data. The range of means of education is included on the left hand side, whereas scale used for nondurable consumption is included in the right hand side. These figures suggest (i) a large drop in expenditures after age 6 and (ii) that inequality in expenditures in education across child's life is larger than in nondurable consumption. Deaton and Paxson (1994) note that consumption inequality should increase with age, however their measure of consumption is nondurable consumption, but 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-cycle; the inequality will be larger the more complements are early investments for later investments in the production function of human capital.

Figure 7 compares the re-scaled and original variable: both the left-hand and right-hand side panels show the decrease in variability in re-scaled variable in NLSY79 compared with original variable.

**Time Use** In Figure 8 show how allocation of time for the two main measures of time used varies with the age of youngest child in household: time parents spend in educational activities and time socializing with children in ATUS[25]. This data is only available from 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 which can be explained by the broad nature of activities included in this variable to mirror time measures related with investment in child's cognitive ability from the NSLY79; there is, however, larger variability at schooling age. Social activities decrease with children's age (reflecting the fact that as children get older the more time they spend with friends/colleagues)[26].[27]

[24]These results are not reported in paper

[25]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)".

[26]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).

[27]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).

### 3.1.2 Income, 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 to 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 on income elasticity, they limit the use of covariates, and budget shares allocated to child's items can be affected by age of mothers and their education, for example.[28]. 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 set of controls. Table 2 presents the marginal effect of log 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 percentile 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 included 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 change in combined share of expenditures in child care, tuition, newspaper, books and toys and child cloth presented in column (1) is zero when income varies, which suggests that these are normal goods, however the magnitude of marginal effect for families in first quartile of expenditures suggests that these are might be inferior goods for these families. Expenditures related with children school (presented in columns (2) and (3)) have unit elasticity - the marginal

[28] 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 are conform with previous estimates.

effect of $\ln TotalExp_{ft}$ cannot be distinguished from zero. Children cloth and hobbies and toys are inferior goods for the poorest families (at the $25^{th}$ percentile of total expenditure), but are normal goods for richer families (this explains the large negative marginal effect for expenditures in children for families in first quartile of 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 inferior goods up to percentile 50 of expenditure and normal goods after.

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 in deficit of food, but also other expenditures that contribute for the quality of child's environment as child cloth, toys, child care and school[29].

**Time Use** Income elasticities for several shares of time use of mothers are presented in Table2-Panel B[30]. 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.

Concluding, large income elasticities found in expenditures and time related to children found in poorer families and families with younger children (0-5) indicate that this is potentially the group with largest behavioral responses from parents if they face fluctuations in their resources.

[29]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.

[30]I restrict estimates of Engel curves to time of mothers because information from CNLSY is collected from mothers - although some of time use estimates presented in main regressions include time of both mother and father, if mother is married.

# 4 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 $t$ are independent of current income. I use a reduced form approach and departure from a permanent income model in which families also have access to the credit market and other insurance possibilities (public and/or private transfers). First, I estimate the effects of unexpected changes in county labor market conditions on family resources and use of private and publicly provided insurance; next, I perform a test of full insurance estimating the effects on family allocations of consumption and time.

**Measure of income shock** There are three ways of estimating 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. Finally, an approach related with the later combines realizations and expectations on income available from survey data to separate the shock from individual's point of view from superior information he might have about the evolution of future income; this approach is followed by Hayashi, 1985, Pistaferri, 2001, and Kaufmmann and Pistaferri, 2009. In this paper, I combine the first two approaches: I use the variation induced by local business cycle in family income and study the time series properties of local business shocks to relate persistency in aggregate and individual's shocks.

It is possible to match respondents in NLSY79 to their county of residence in each year and with measures of local business cycle available from external data. Official local unemployment rate in the U.S. is measured from the Current Population Survey (CPS), the monthly household survey of the population that is designed to represent the civilian noninstitutional population of the United States[31]. The time-series of unemployment rate for each county from 1976 to 2006 is available from the Bureau of Labor Statistics. The local business is measured by an unpredicted component of each county's unemployment rate. In particular, I use county unemployment rate after county and year effects are accounted for:

[31]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.

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

where $\pi_c$ accounts for counties' fixed characteristics, such as 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, whereas $\pi_t$ accounts for uninsurable economy-wide shocks. This measure of shock is similar to "weather variability" used in Paxson, 1992, and covers all years in NLSY79.

Then, I assume the log income of family $f$ residing in county $c$ in year $t$ can be described as

$$\ln y_{fct} = \gamma_0 + \gamma_1' X_{fct} + \pi_f + \pi_c + \pi_t + e_{fct} \tag{14}$$

where $X$ accounts for life-cycle variation. Families' earnings capacity increases with age, and this is captured by a polynomial in mother's age. I control for family size to scale for the household's needs. The remaining control variables are marital status, education and age structure of children in family (presence of children age 0-2, 3-5, 6-9 and 10-14). The family fixed effect, $\pi_f$, accounts for permanent differences in families' luck with respect to shocks faced; as NLSY79 is not a balanced panel family fixed effects also account for permanent differences in families with different attrition rates. These control for possible omitted variable bias (e.g., if a child arrives to the family, its tastes change), because if the shock, $\varepsilon_{ct}$, is truly exogenous then it should be orthogonal to $X$ and $\pi_f$. County fixed effects, $\pi_c$, are included to control for permanent differences in county's resources and average quality of families and for the difference in county sampling in CPS (from which unemployment rate is measured) and NLSY79. Year effects, $\pi_t$, control for uninsurable economy-wide shocks.

The quasi-experimental approach followed has advantages and disadvantages when comparing to the alternatives. Studies that rely on statistical decomposition of shocks on earnings rely on narrowly defined samples of continuously married and continuously employed prime age males, usually using panel data from PSID. The NLSY has some limitations to apply this type of procedure. First, I use data from the Children of the NLSY (the only panel data with parenting and child's human capital measures available for a sufficiently large number of years for the U.S.), and so I can only use data for families of females. Second, restricting the sample to stable families will likely underestimate the risks faced by families, in particular, will ignore the group of credit constrained families, to whom are relevant possible lessons on how parents decide facing shocks for the design of poverty alleviation programs such as the AFDC/TANF, Head Start or Medicaid.

County labor market conditions provide a clear source of variability in income: it captures an exogenous shock in county's capacity of generating resources if there is a drop a surprise drop in demand for labor. I first provide a brief description of what is the role county within the US' structure of government which is useful to understand the scope for county level policy in manipulating the business cycle and then I explain the assumptions on how shocks at county level

shocks may impact families' resources.

**Counties** 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[32].

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[33]: (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 provide many facilities, such as airports, convention centers, museums, beaches, harbors, zoos, clinics, law libraries, public housing, courts, law enforcement and child and family services and other welfare services. Controlling by families' time-varying characteristics accounts for changes demographic structure of families in county (e.g., proportion of schooling age children), which relate to the services provided locally.

**Identifying assumptions: the information set of families** The identification strategy used assumes that the idiosyncratic component $e_{fct}$ can be written as function of local business cycle, $\varepsilon_{ct}$, and an a time-varying component, $\eta_{fct}$,

$$e_{fct} = f\left(\varepsilon_{ct}, \eta_{fct}\right). \tag{15}$$

I control for sorting of families across counties according to local shocks by including family fixed effects, which account for level of each family information about quality of county. This is a sensible assumption because shock identified is persistent (I discuss the time series properties of local shock in Section 5). Additionally, the following should hold for $\varepsilon_{ct}$ to be an exogenous source of variation: (i) $Cov\left(\varepsilon_{ct+k}, \eta_{fct}\right) = 0$ for $k > 0$ so that families cannot predict local shock; (ii) $Cov\left(\varepsilon_{ct-k}, \eta_{fct}\right) = 0$, for $k > 0$, time-varying idiosyncratic shocks are cross-sectional orthogonal to past aggregate shock; (iii) $Cov\left(\eta_{fct}, \eta_{fct-k}\right) = 0$ for all $k$ which implies that time-varying idiosyncratic shocks are not serially correlated within families; (iv) $Cov\left(\eta_{fct}, \eta_{f'ct-k}\right) = 0$ for all $k$ and $f \neq f'$, and the time-varying idiosyncratic component of shock is not correlated across families.

Because I rely on different sources of data to construct the income shock and measured income, sampling variation and measurement error in $\eta_{fct}$ is likely to be uncorrelated with $\varepsilon_{ct}$, additionally

[32]The most heavily populated county of the U.S., Los Angeles County, California, has a population of approximately 9,880,000, and the least populated county is Loving County, Texas, with a population of 58. See BEA, 2006, Table CA1-3-20 Personal income summary: Population.

[33]See http://www.naco.org.

unemployment rate is measured from a larger sample drawn from the same population than the NLSY79[34]. Measurement error leading to attenuation bias in estimated coefficients of insurance may induce false nonrejections of the hypothesis of full insurance.

With these assumptions the relationship between income and local business cycle can be written as

$$\ln y_{fct} = \gamma_0 + \gamma_1' X_{fct} + g\left(\varepsilon_{ct}, X_{fct}\right) + \pi_f + \pi_c + \pi_t + \eta_{fct} \tag{16}$$

where the impact of county level shocks on income is allowed to depend on family observable characteristics contained in $X_{fct}$ and function $g$ will be assumed to be parametric in empirical analysis (e.g., less educated individuals are more likely be to affected by a shock on labor demand).

Additionally, the unexpected county unemployment rate is only valid as exogenous variation of idiosyncratic shocks if it provides marginal variation to family resources once life-cycle factors and economy-wide shocks are accounted for. This might not be case if families do not value aggregated 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 more likely to impact directly individuals than nation-wide changes, while providing cross-sectional and time-series exogenous variation. 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).

It is possible to argue that supply of local services might be correlated with county shocks, which could lead to biased estimates of the effects of shocks, violating assumption $Cov\left(\varepsilon_{ct-k}, \eta_{fct}\right) = 0$ for all $k$. 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.

Other issue concerns the relevance of unexpected county unemployment rate as measure of income shocks for the families represented by NLSY79 sample. Unemployment rate data used to obtain local labor market shocks is based on the CPS, this combination of data might not be meaningful if the two populations are different. This is unlikely because CPS and NLSY79 are both drawn from the U.S. population; but CPS is a representative sample of the U.S. working age population whereas the NLSY79 contains an over-sampling of disadvantage families and follows individuals born between 1957 and 1964. Therefore, I limit the main results presented in the paper to the representative sample of NLSY79[35].

Finally, response of consumption to income shocks depends on the persistency of the shock,

[34]See Imbens and Lancaster, 1994, for the informational gains on combining micro and macro data sets.

[35]Results in Appendix C compare baseline results with results obtained from the whole sample.

but the use of labor market shocks limits the test to responses of shocks with different persistency. I address this issue by study time-series properties of local business cycles.

**Comparison with other approaches**[36] One commonly used approach to identified idiosyncratic risk is to use variance of residual income, where the underlying sources of risk are not specified. Comparing with specification (15) papers that use a statistical decomposition of shocks assume

$$e_{fct} = p_{fct} + v_{fct} + m_{fct} \tag{17}$$

where $p_{fct}$ is a permanent component that follows a random walk, $p_{fct} = p_{fct-1} + \xi_{fct}$, $v_{fct}$ is the transitory shock that follows an $MA(q)$ process and $m_{fct}$ is classical i.i.d. measurement error[37]. Using local business cycles as exogenous variation allows for persistent shocks but leaves unspecified the process for families residual income $e_{fct}$.

The approach followed in this paper is closer to Attanasio and Davis, 1996, and 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; as mine, their approach relies on unemployment rates measured from an outside data relatively to the one where insurance hypothesis is being tested.

# 5 Results

The goal of this paper is to study how well can parents 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.

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.

[36] Future research 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. To identify the effects of all yearly variances of permanent and transitory shocks one needs to use moments superior to second order.

[37] See MaCurdy, 1982, Abowd and Card, 1989, Gottschalk and Moffitt, 1995, Meghir and Pistaferri, 2004, just to name a few studies.

## 5.1 How do labor market shocks change family resources?

I start by presenting estimates for model (14) in Table 3. In particular, I estimate the following parametric model:

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

where $\gamma_2$ captures the variation of income induced by the shock once deterministic factors included in $X_{fct}, \pi_f, \pi_c$ and $\pi_t$ are accounted for. $X_{fct}$ controls for tastes shifters determined by demographic structure, in particular I control for 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 and mother's education. I control for family fixed effects, $\pi_f$, year effects, $\pi_t$ and county effect, $\pi_c$ (see Section 4). What is left unexplained is an idiosyncratic time-varying shock.

All results are presented for three main samples: representative sample of families and by mothers' education (no college and at least some college). All standard errors are obtained by block-bootstrap with 250 replications (the block is the county) to account for common shocks within county.

Table 3 estimates the effects of local labor market shocks on mothers' labor market participation, family earnings and total family income[38]. Column (1) shows that a 1 percentage point increase in unexpected unemployment decreases participation of mothers in 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) Do families where members have permanent labor contracts are affected by shocks to the same extent than families where temporary contracts are dominant in attachment to labor market?, (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 mothers' education: no college and at least some college attendance[39]; 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).

[38] Family earnings include wages and farm and business income of mother and husband if married. Family income includes total earnings, private and public transfers and capital income.

[39] 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).

To assess how general are 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 differently families with more than one earner, I allow the effects to vary by marital status. Estimates in columns (1) to (3) 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[40]. Columns (4)-(6) and (7)-(9) present estimates separately for females and males, respectively, allowing the effect to vary by education group. I confirm the findings for the overall sample: there are no effects on participation rate; the large effect on earnings is driven by families with the lower education group, and effects on total family income appear only the group of less educated families.

Columns (1)-(4) Table C2 in Appendix C present estimates for married women from main sample and columns (5)-(7) for single women; in all specifications the effect varies with mother's education. Columns (1) and (2) reveal that shock does not affect participation of women or their spouses in married families, however, a 1pp shock is associated with a 1 percent change in family earnings for families in the no college group (which are driven by effects on the intensive margin of participation for females); column (4) shows that the effect on earnings is only passed on to income of families of college mothers. However, 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; 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 shock during the year[41]; inspection using the entire sample of the NLSY79 (regardless of gender of respondent) reveals that the number of hours worked in the no college group decreases (either females or males), which drives down family 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 4, the identification approach used will not be valid if families can anticipate local labor market shocks (see Assumption (i)). If this is the case then they will incorporate it in their decisions plans and the shock will not affect consumption. Table 4 presents a simple test for this possibility: conditional on shock in $t$, mother's

[40]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.

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

participation, family earnings, family total income or welfare income families receive in period $t$ are unrelated with shock families receive in period $t+1$. The shock is, therefore, a true "surprise" to families and future shocks are not part of families' information set.[42]

Confirmation that shock is truly a shock on families' perspective is especially important because local labor shocks are fairly persistent. I studied the time series properties of residual unemployment rate. 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), 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 significative in most years[43]. The large drop from first to second order autocovariances suggests a first order moving average process. Combined evidence from variance-autocovariance matrix and partial autocorrelations suggests that the stochastic process can be described by an ARMA(1,1). I then estimated the overall time series for 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 an AR(1) and ARMA(1,1) processes; Panel B of same table presents the distribution for estimation 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 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 statistical decomposition approaches that decompose idiosyncratic shocks into permanent and transitory components.

**Mechanisms of insurance** To isolate consumption for the effects of shocks families may use: private and/or public transfers or savings. In Table 6 presents estimates of model (18) using as dependent variable total unearned income, 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[44], but a 1pp unemployment shock rises welfare income in $40 per year. Comparing columns (5) and (8) unveils that the effect is due to the increase on welfare use by the group of no college mothers; no effect exists for sample of college mothers, instead these families rely on accumulated assets against labor market shocks, which is shown by an average decrease of $4200 in the value of assets.

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

[43]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.

[44]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.

These results (together with estimates using private transfers as dependent variable) suggest that private transfers are not used to ameliorate the effect of shock.

To summarize: First, the local labor market shock identified is caused by movements in/out of the market of a relatively small (and marginal) group of individuals - single mothers. Other 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. Second, there is a heterogeneity in effects of shocks: individuals with less qualifications are more affected than the college educated group. Third, families use different insurance mechanisms to insure against shocks: more disadvantage families use welfare income[45], less disadvantage families use accumulated assets to buffer the effects of shocks.

## 5.2 Insurance Test

Table 7 presents the main results in this paper. I estimate the effect of county's shock $\varepsilon_{ct}$ 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 cloth and nondurable consumption, and on measures of time spent with children, either teaching and involved on education activities or leisure activities parents develop together with their children, as eating or socializing. The effect of shock is estimated from the following regression for each family $f$ living in county $c$ in year $t$:

$$\ln C_{fct} = \alpha_0 + \alpha_1 \varepsilon_{ct} + \alpha_2' X_{fct} + \pi_f + \pi_c + \pi_t + \upsilon_{fct} \tag{19}$$

Families can full insure against shock if the null hypothesis that $\alpha_1 = 0$ cannot be rejected: the shock is orthogonal to families' consumption decisions. Again, controls for family characteristics, $X_{fct}$, are included to control for taste shocks related with family structure, and family, $\pi_f$, county, $\pi_c$ and year effects, $\pi_t$, control for families' permanent characteristics, county's quality and uninsurable aggregate shocks, respectively. Not controlling for these variables may induce false rejections of full insurance hypothesis.

Columns (1) and (2) of Table 7 show that it is not possible to reject the hypothesis that the shock is orthogonal to decisions of spending in children, and this holds for the three samples analyzed: for the whole sample, and for families of no college mothers and college educated mothers in Panels B and C. But some caution should be taken with the interpretation these point estimates. First, both estimates in Panel A are imprecise imprecise; this worsens when sample is separated by mothers' education. Re-scaling expenditures adds an extra source of measurement error and the smaller the information set used to match data, the higher is this measurement error. As

[45] 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) in the sample of low educated sample (standard errors in parenthesis).

there is no information on purchases of child's cloth in the CNLSY, imputation is based on the degree of complementarity of these expenditures with observed variables in the main data set[46]. 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 education (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. Again information used to impute information from CEX is based on family characteristics and parenting variables in the NLSY79 (Table A9 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 percent in household consumption, rejecting the hypothesis of full insurance, which corresponds to an average drop of 476 dollars in annual expenditure. Estimating the same effect by education group in Panels B and C (i) increases the imprecision in estimated effect - expected given the reduction in sample size, (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). Note that this last set of families was the only affected by changes in total family income, as the effect on earnings for families in the no 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 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[47]. The effects on allocation of time are remarkably different by education group[48]. 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 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 mother's spend reading[49] for own interest the sign of the

[46]Table A9 shows that variability explained by proxy variables observed in the NLSY79 and family characteristics never exceeds 35 percent for expenditures in child cloth.

[47]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 no 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.

[48]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 A13. From this table distribution of imputed variables in columns (1) to (3), which correspond to variables in columns (3) to (5) in Table 7, present moments closer to the original variable, and are therefore chosen to be included in main results.

[49]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

effect is reverted and the effect adds to 7 minutes per week. The time parents spend organization and planning for household children, attending household children's events or socializing (as shorter version, I refer to it as time socializing)[50] increases by 4 minutes per week with 1pp shock.

Investigating the effects by group of education reveals that the negative effect of 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 own interest than magnitude of effect is similar in both samples. Also changes in time socializing are driven by the sample of no college mothers. Although the changes in time out of the market available to parents in both samples is very similar, most of the variation on the use of time appears from the sample of less educated mothers; of course, it should be noted that the magnitude of changes on time allocated towards children amounts to half-dozen of minutes per week, and it will be important to evaluate to which extent this is translated to child's human capital.

Summing up: although families of no college mothers have the effect of shock insured by public transfers, which is mirrored on the full-insurance in all consumption measures analyzed, these families present larger responses on parental use of time: they substitute time dedicated to children education by leisure activities. On the contrary, 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 of the no college groups, 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 5.6.

## 5.3 Effect of income on family's decisions

To compare with other papers that study the effects of income or earnings shocks Table 8 presents 2SLS estimates of the effects of the shock on earnings and income, instrumented by the local labor market shock, $\varepsilon_{ct}$, on time and consumption allocations. The model estimated for each family $f$ living in county $c$ in year $t$ is:

$$\ln C_{fct} = \kappa_0 + \kappa_1 \ln y_{fct} + \kappa_2' X_{fct} + \pi_f + \pi_c + \pi_t + \xi_{fct} \tag{20}$$

Columns (1) and (2) in Table 8-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

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".

[50]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 in A9 in Appendix A for correspondence between CNLSY and ATUS.

reject that income/earnings changes have no effect on expenditures in child cloth, but the sign of point estimates is the expected by Engel curve estimates[51]. These estimates can be compared with changes in nondurable consumption presented in column (6): 10 percent income shock changes nondurable consumption in 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. The measure of shock used here is less persistent than permanent shocks in BBP (with an autoregressive coefficient of 0.8); 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 a almost one-to-one substitution of time spent socializing by educational activities to income changes; 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)).

When sample is divided by mother's education a 10% increase in earnings is associated with a 12% increase in expenditures in education in the group of no 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 a that change earnings have a similar effect in 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 in children (but not changes in earnings)[52].

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 no college group. Panel C shows that changes in family income/earnings are not associated substitution of leisure with children by education.

## 5.4 Lasting effect

As discussed in subsection 5.1 the shock identified is persistent. Table C3 in Appendix C shows that shock has lasting effects on participation and earnings of families in low education group. However, the effects on income are not persistent. So, what are the consequences of identifying a persistent shock for the estimates obtained? Once families receive the "surprise" they incorporate the new information into their consumption and investment plans, therefore a shock in $t$ should only affect

[51] Child cloth is an inferior good or a necessity - see Table 2-Panel A.

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

decisions when it is revealed and after period $t$ families have already taken the shock into account. Therefore, one should anticipate that lagged shocks should not affect current consumption and investment decisions. But because the shock has a persistent effect on the time in labor market it is expected a persistent effect in the allocation time.

Table 9 shows 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.

## 5.5 Excess smoothing/excess sensitivity?

Table 8 presented evidence of rejection of full insurance hypothesis on families' consumption and changes in families allocation of time, with different behaviors for families of more and less educated mothers: (i) increase in family resources are associated with increase in time parents spend involved in children's education, a decrease in leisure, and an increase in expenditures in education in families of no college mothers, but (ii) there almost no changes in the allocation of time by more educated parents. Together these results suggest that (1) time spent involved in educational activities is complement of expenditures in education, (2) parents smooth the effects of shock in their children's allocations more than in total household consumption.

But why is there a substitution effect between time in education and time spent in recreational activities in Panel B of Table 7? Why parents do not use the extra time out of the market in their children's education? To understand this, shocks are divided into positive and negative. The intuition for this splitting is driven by predicted response to changes in income when investments are complementary over time: if families face a positive shock they may use the unexpected gains in investment; and may try to smooth negative shocks, specially if these occur in critical periods for the effectiveness of some investments (early in children's lives).

Table C4 in Appendix C shows that unemployment shocks are better predictor for changes in families' resources for negative than for positive shocks for families in the no college group. Unexpected increases in unemployment rate result from large drop in labor market participation of mothers (a 1pp shock is associated with a decrease in 1.78 percent in participation) and this causes a decrease in families of 2.3 percent for no college families. In contrast, positive shocks are better predictors of earnings increases in the college educated group.

Table 10 shows that time parents spend involved in educational activities is more elastic to positive than to negative shocks for no college mothers (see Panel B), but is inelastic to any shocks for college mothers (see Panel C). Total resources of low educated families are not affected by negative shocks - recall from Table 4 that they use welfare income as buffer to shocks - and parents smooth time in education, but simultaneously increase time socializing. On the contrary, when facing a positive shock of 1pp they increase the time in education by 11 minutes per week in substitution of leisure time. The later behavior can be explained if parents perceive that the

return of these type of investment is high (and essential for the productivity of later investments, so that investments are complements over time), and so they take advantage of the unexpected higher gains.

## 5.6 Child's life cycle

I start by estimating how effects of shocks vary with the age of youngest child in household. Table C5 in Appendix C shows variation in resources when the effect of shock varies with the age of youngest child in family. Panel A shows that shock affects participation of mothers whose youngest child is 6-14 years old, and it is associated with decrease in family earnings specially 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, although there is an increase in welfare income for these families.

Dividing the effects by mothers' education unveils that most of the effects are driven by the sample of no 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, which is only significantly different from zero 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 on Table 3 is driven by families with young children (0-5), which causes a drop on family income; again, there are no effects on total unearned income or welfare income for these families.

Are effects on resources transmitted to parents' consumption and time decisions? These estimates are presented Table 11. For the entire sample (Panel A), columns (1) and (2) show no reaction to shock in expenditures in education and child cloth. However, estimates for nondurable consumption in Column (5) reject the hypothesis of full insurance on nondurable consumption for the group of families with young children (0-5 years old). Columns (3) and (4) show the effect on allocation of time: the substitution of time in education related activities and socializing is driven mainly by families with very young children; if youngest age in family is 6 to 14 years old (school age) I cannot reject the null hypothesis of no effects in time allocated to education.

Panels B and C of Table 11 show the effects for no college and college educated mothers, respectively. Estimates presented in columns (1), (2) and (5) do not allow reject the hypothesis of full insurance on either child specific and nondurable consumption in the sample of no college mothers, however columns (3) and (4) show a large substitution of time in education and by socialization only on families with children 0-5 years old. On the contrary, 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)).

## 5.7 Effects on child human capital

Thus 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)), so that

$$h_t = f\left(g_0...g_f, i_0...i_f, p_0...p_f, \varepsilon_0...\varepsilon_f, h'_T\right) \tag{21}$$

where $h_t$ is human capital at age $t$, $\{g_0...g_t\}$ 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. To simplify the analysis, suppose there are only two types of investments (which were studied above), time and goods. Then effect of an income shock at age $j$ on age $t$'s human capital is:

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

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 activitities on the group of no college educated mothers with children 0-5 years old. Is this behavioral reaction passed onto child's human? 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 Dahl and Lochner, 2008). 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[53] and find that temporary increases 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:

$$i_{kfct} = \alpha_0 + \sum_{j=0}^{14} \alpha_{1j}\left(\varepsilon_{ct} \times 1\left[Age_{kfct} = j\right]\right) + \alpha'_2 X_{fct} + \sum_{j=0}^{14} \alpha_{3j} \times 1\left[Age_{kfct} = j\right] + \pi_k + \pi_c + \pi_t + e_{kfct} \tag{22}$$

where $i_{kfct}$ is a measure of investment in child's $k$ 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. $X$

[53] Earned Income Tax Credit.

includes quadratic of mother's age, family size, indicators for the presence of children 0-2, 3-5, 6-9 and 10-14 years old in family, mother's education and marital status, $\pi_k$ is a child fixed effect (to account for child permanent characteristics), $\pi_c$ is a county effect and $\pi_t$ are year fixed effects.

Figure 9 includes estimates for $\alpha_{1j}$, $j = 0, ..., 14$. Figures in first column shows estimates for all sample: the effect of shock 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 with education and an increase in time socializing; and magnitude of both 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 time socializing it is not possible to reject the null of no effect after age 8. Dividing the sample by mother's education in second and third columns of Figure 9 shows (again) that substitution of time in education by leisure is driven by behavior of families of no college mothers.

Figure 10 includes estimates for $\alpha_{1j}$, $j = 5, ..., 14$ 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) - a 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 no college mothers[54].[55]

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.[56]

# 6 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 re-scaled these variables using similar expenditures and time use measures available from the CEX and the ATUS, respectively.

I use county business cycles as exogenous variation for unexpected income changes. In particular, I use an unpredicted component of local unemployment rate obtained after year and county effects are accounted for. Although a similar approach has been followed using data from developing countries (e.g., Paxson, 1992) this source of variation had not been exploited in long panels

[54]Including the oversample of disadvantaged families provides more precise estimates.

[55]Estimates of model (22) for children ages 3-15 using PPVT - Peabody Picture Vocabulary Test - as dependent variable show a similar pattern than that for PIAT.

[56]I have estimated the effects of past shocks on test scores at ages 13-14 and could not distinguish them from zero.

for the U.S. economy.

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: whereas a surprise increase in county unemployment decreases earnings in families of college and non-college educated mothers, the later group can shield the effect of shock resorting on welfare income, whilst the college group uses accumulated assets as insurance. 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. By changing the relative price of time, the shock causes changes in families' allocation of time: families 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.

By dividing shocks into positive and negative I find that positive shocks are associated with an increase in time devoted to children's education and reduction in time socializing with their children, whilst parents try to smooth the effects of negative shocks on time spent in education. This asymmetric response to different types of shocks in families with young children suggests that parents recognize that early years are fundamental for the development of their children and some investments are critical for the productivity of later investments. Finally, parents of young children are more sensitive to shocks: the substitution effect in allocation of time is explained by families of non-college educated mothers with children less than 5 years old.

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. For 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 explicitly estimate the Euler equations for investment in human capital sketched in model of Section 2; this would allow to recover parameters of the production function of human capital for different types of investments, including public investments.

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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 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 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 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 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 | 0.01 | 0 | 0 |

Note: 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%.

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 at home, food away from home, 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, babysitting, education, domestic services, other home services, rentals, personal care, toys, games and hobbies.

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 0-2 | | | | | | |
| at the 25th percentile of expenditure | 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 expenditure | 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 expenditure | 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 effect: age 3-5 | | | | | | |
| at the 25th percentile of expenditure | 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 expenditure | 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 expenditure | 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 effect: age 6-9 | | | | | | |
| at the 25th percentile of expenditure | 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 expenditure | 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 expenditure | 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 effect: age 10-14 | | | | | | |
| at the 25th percentile of expenditure | -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 expenditure | 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 expenditure | 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: 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%.

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 (hhld) children, talking with/listening (hhld) 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: hours per week - dependent variable is % of weekly hours in a given activity.

[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) Participation** | **(2) Log family earnings** | **(3) Log family income** | **(4) Log welfare Income** |
|---|---|---|---|---|
| Sample | Panel A: All | | | |
| Decision variable in t | -0.00009 | 0.000003 | 0.00013 | 0.000045 |
| | [0.000302] | [0.000201] | [0.000123] | [0.000068] |
| Shock in t | 0.649464 | 0.649539 | 0.64968 | 0.649307 |
| | [0.026249]*** | [0.026240]*** | [0.026268]*** | [0.026300]*** |
| Observations | 13227 | 13227 | 13227 | 6919 |
| Number of mothers | 2241 | 2241 | 2241 | 1169 |
| Sample | Panel B: Mothers education ≤12 years | | | |
| Decision variable in t | 0.000205 | 0.000008 | 0.00022 | 0.000044 |
| | [0.000258] | [0.000444] | [0.000162] | [0.000100] |
| Shock in t | 0.634613 | 0.63428 | 0.634391 | 0.634015 |
| | [0.035754]*** | [0.035813]*** | [0.035833]*** | [0.035892]*** |
| Observations | 6919 | 6919 | 6919 | 6919 |
| Number of mothers | 1169 | 1169 | 1169 | 1169 |
| Sample | Panel C: Mothers education >12 years | | | |
| Decision variable in t | -0.00039 | -0.000288 | 0.000012 | 0.000031 |
| | [0.000366] | [0.000460] | [0.000173] | [0.000084] |
| Shock in t | 0.675579 | 0.676082 | 0.676161 | 0.676043 |
| | [0.024109]*** | [0.024043]*** | [0.023994]*** | [0.023994]*** |
| Observations | 6308 | 6308 | 6308 | 6308 |
| Number of mothers | 1072 | 1072 | 1072 | 1072 |

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) and (4) is Log(X +1). Sample used in estimation: cross-sectional sample of NLSY. * significant at 10%; ** significant at 5%; *** significant at 1%.

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) |
|---|---|---|---|---|---|---|---|
| **Dependent variable** | **Log Expenditures** | | **Children** | **Time use** | | **Household** | |
| | **in education** | **in child cloth** | **Education** | **Education/reading** | **Socializing** | **Log nondurable consumption** | **Hours worked 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 - 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 cloth** | **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 9 - 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 10 - 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 cloth** | **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%.

**Table 11 - 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 cloth** | **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.

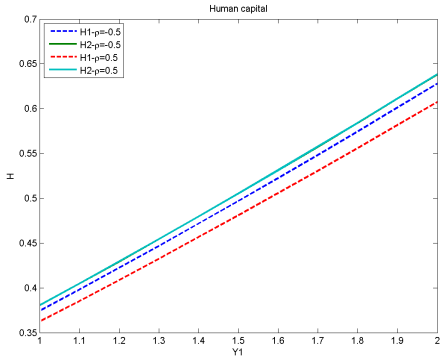
# Figures

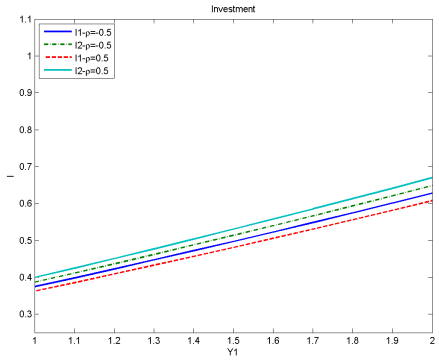
**Figure 1A: No uncertainty, no credit constraints, relative productivity equal across periods**[1]

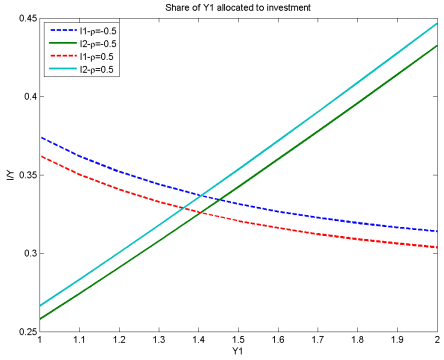
The model simulated here assumes that $\rho_1 = \rho_2 = \rho$, so that:

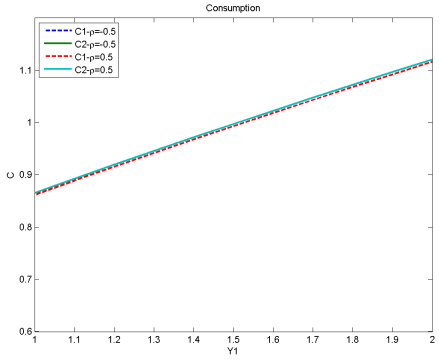
$$\begin{aligned} h_2 &= \left[\theta_2 g_2^{\rho} + (1-\theta_2)\,\theta_1 g_1^{\rho} + (1-\theta_2)\,(1-\theta_1)\,\omega^{\rho}\right]^{\frac{1}{\rho}} \\ h_1 &= \left[\theta_1 g_1^{\rho} + (1-\theta_1)\,\omega^{\rho}\right]^{\frac{1}{\rho}} \end{aligned}$$

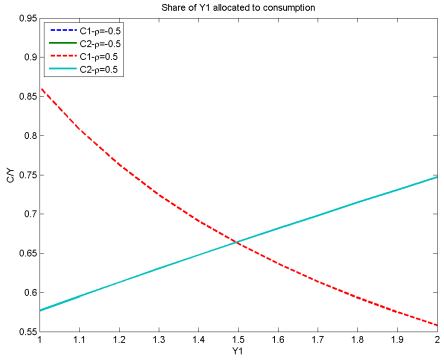
Start with $\omega = 0$ (endowment). Then, $h_2 = [\tau g_2^{\rho} + (1-\tau) g_1^{\rho}]^{\frac{1}{\rho}}$, where $\theta_2 = \tau$, $\theta_1 = 1$.
Parameters: $\beta = 0.96, r = 0.05$, $\sigma_1 = \sigma_2 = 2$ $\gamma = 1$, $\tau = 0.5$.
Income: between 1 and 2 in $t = 1$, 1.5 for everyone in $t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

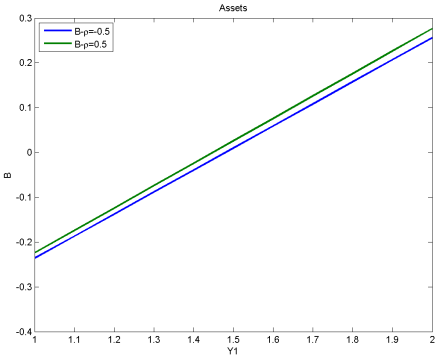


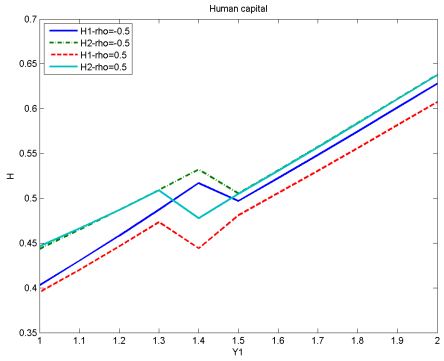

[1] The initial conditions and tolerance levels used solving the model are the same in all models.

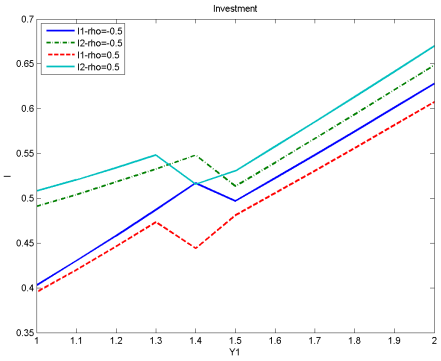
**Figure 1B: No uncertainty, credit constraints** $a \geq 0$

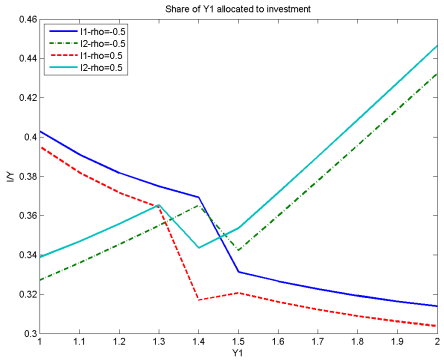
Parameters: $\beta = 0.96, r = 0.05$, $\sigma_1 = \sigma_2 = 2$ $\gamma = 1$, $\theta_2 = 0.5$, $\theta_1 = 1$, $\omega = 0$

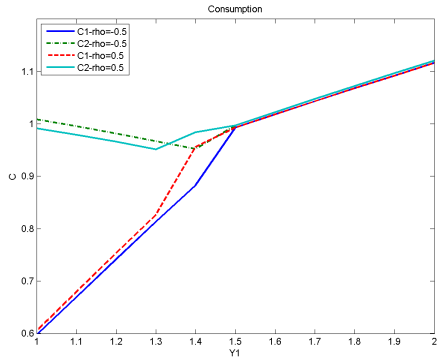
Income: between 1 and 2 in $t = 1$, 1.5 for everyone in $t = 2$.

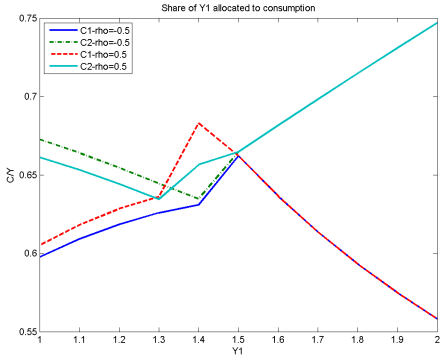
Parents are no longer able to smooth their consumption if credit constraint. Constrained families with $\rho = -0.5$ need spend a relatively high proportion of period's 1 income to compensate for low substitutability of investment across periods.



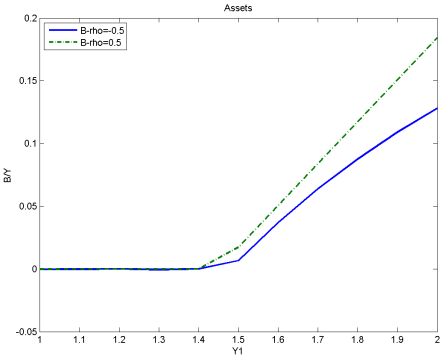



Figure 2 - Distribution of hours worked per week by mothers (data source: Mothers of Children of NLSY79 1979-2006).

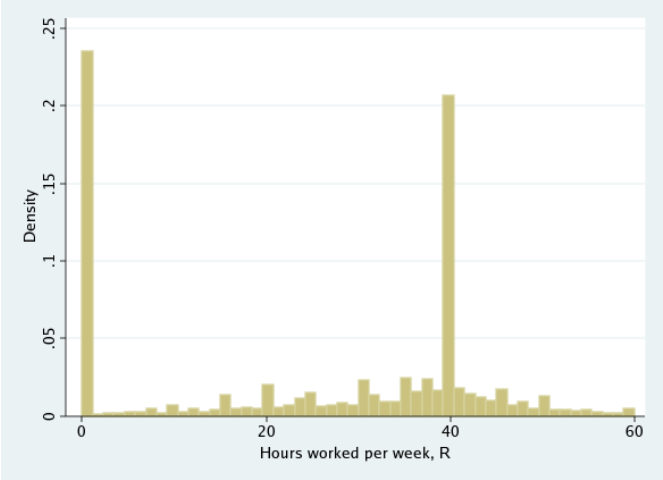
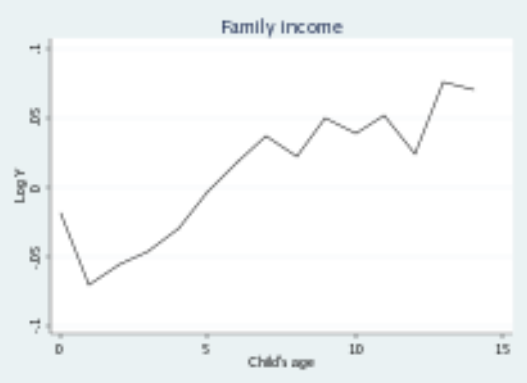



Figure 3 - Average hours worked and income across child's life cycle (data source: Mothers of Children of NLSY79 1979-2006).

Characteristics of shock

Figure 4a - Density of county shock (data source: BLS 1976-2006).

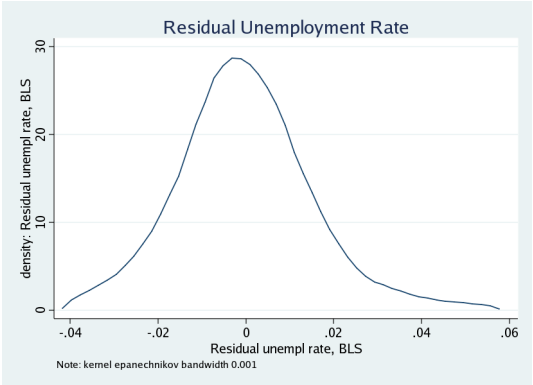
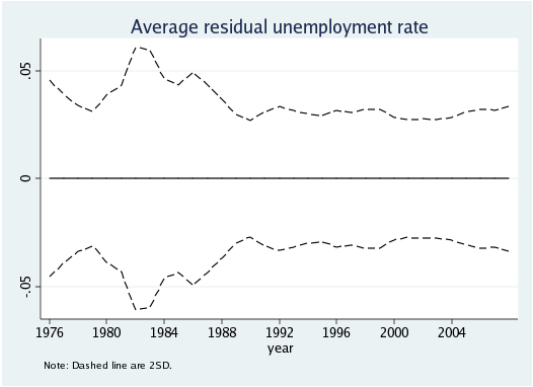


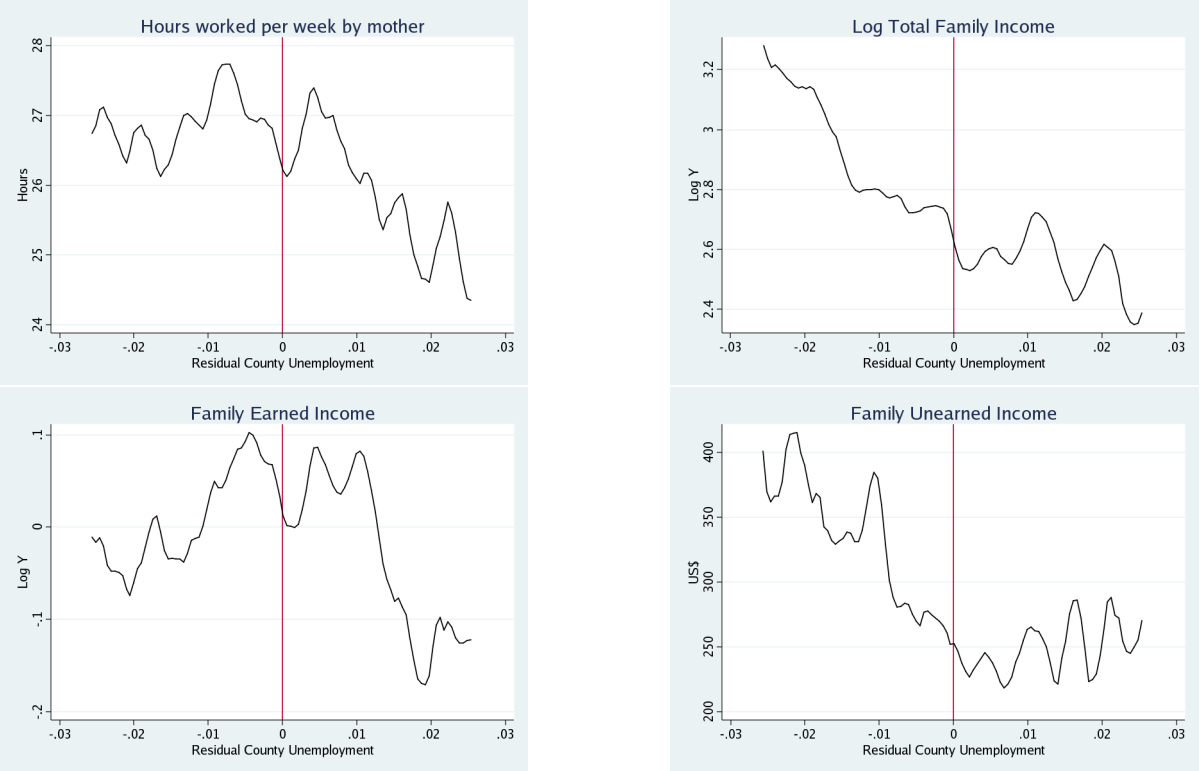

Figure 4b - Yearly variation of shock (data source: BLS 1976-2006).




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

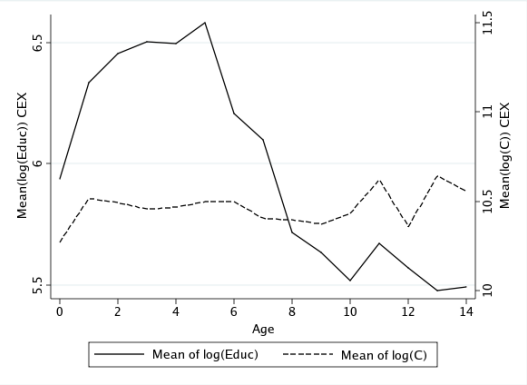
| | Shock |
|---|---|
| Observations | 103531 |
| Mean | 0.00000 |
| SD | 0.01840 |
| P5 | -0.02672 |
| P25 | -0.01040 |
| P50 | -0.00093 |
| P75 | 0.00900 |

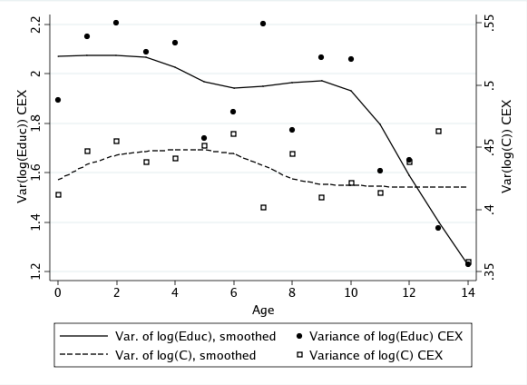
Figure 5 - Variation of hours worked per week by mothers, family income, earnings and unearned income with county shock (data: Children of NLSY79 1986-2006).




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.

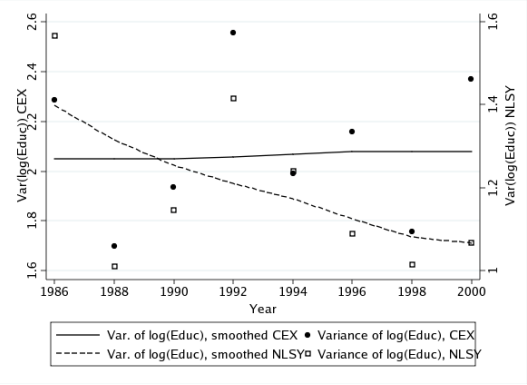
Figure 6 - Mean and variance of (log) expenditures in children and nondurable consumption over child's life cycle (source: CEX 1983-2000).




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



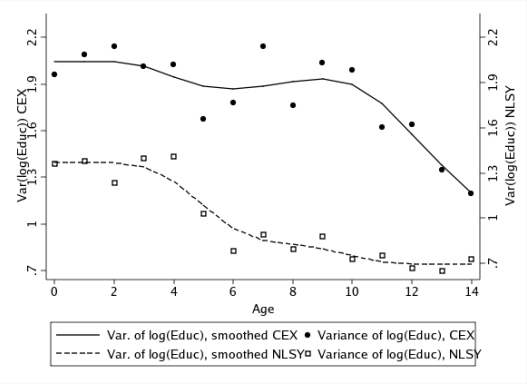
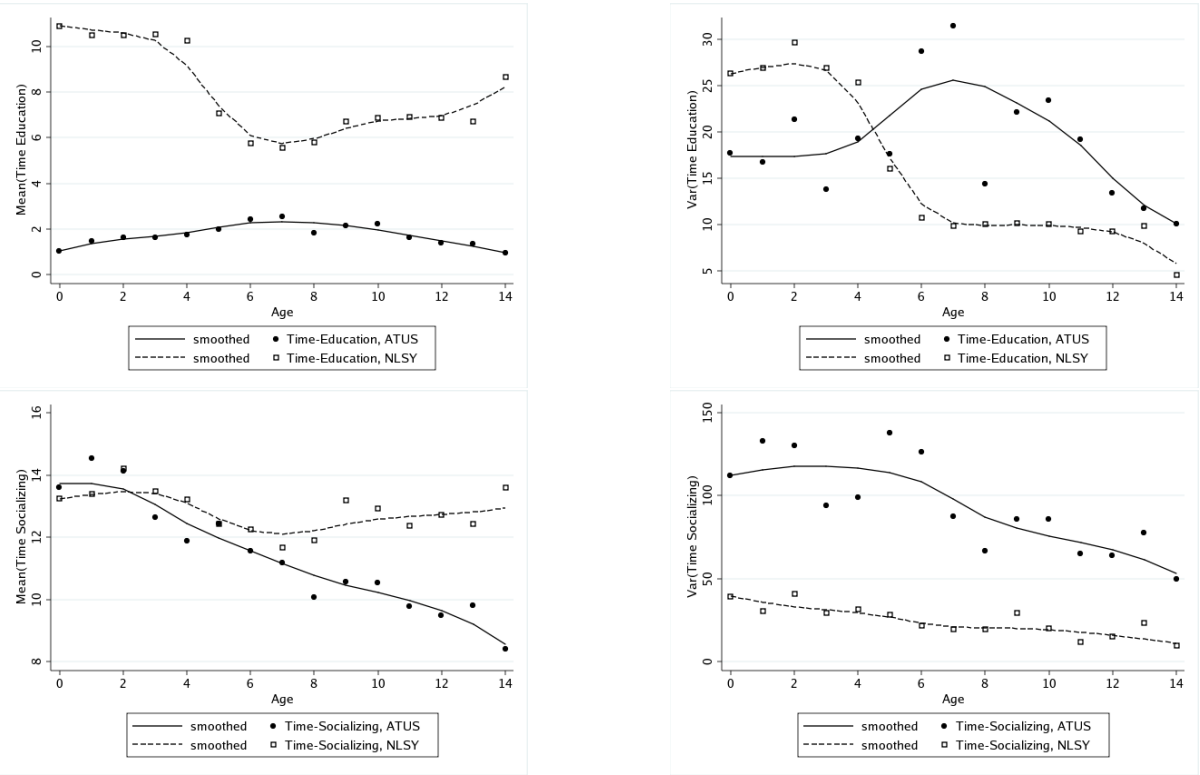



Figure 8 - Mean and variance of for time use variables in ATUS and NLSY - original and re-scaled variable:




Note: Mean and variance of main time use variables used in empirical analysis.

Time in Education includes: time helping children with homework or learning simple things as numbers and alphabet, talking to child, discussing TV programs or reading to child. The ATUS' variable includes "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 includes 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 he ATUS' variable includes "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 A10 and A12 for construction of NLSY and ATUS variables.

Unit: hours per week.

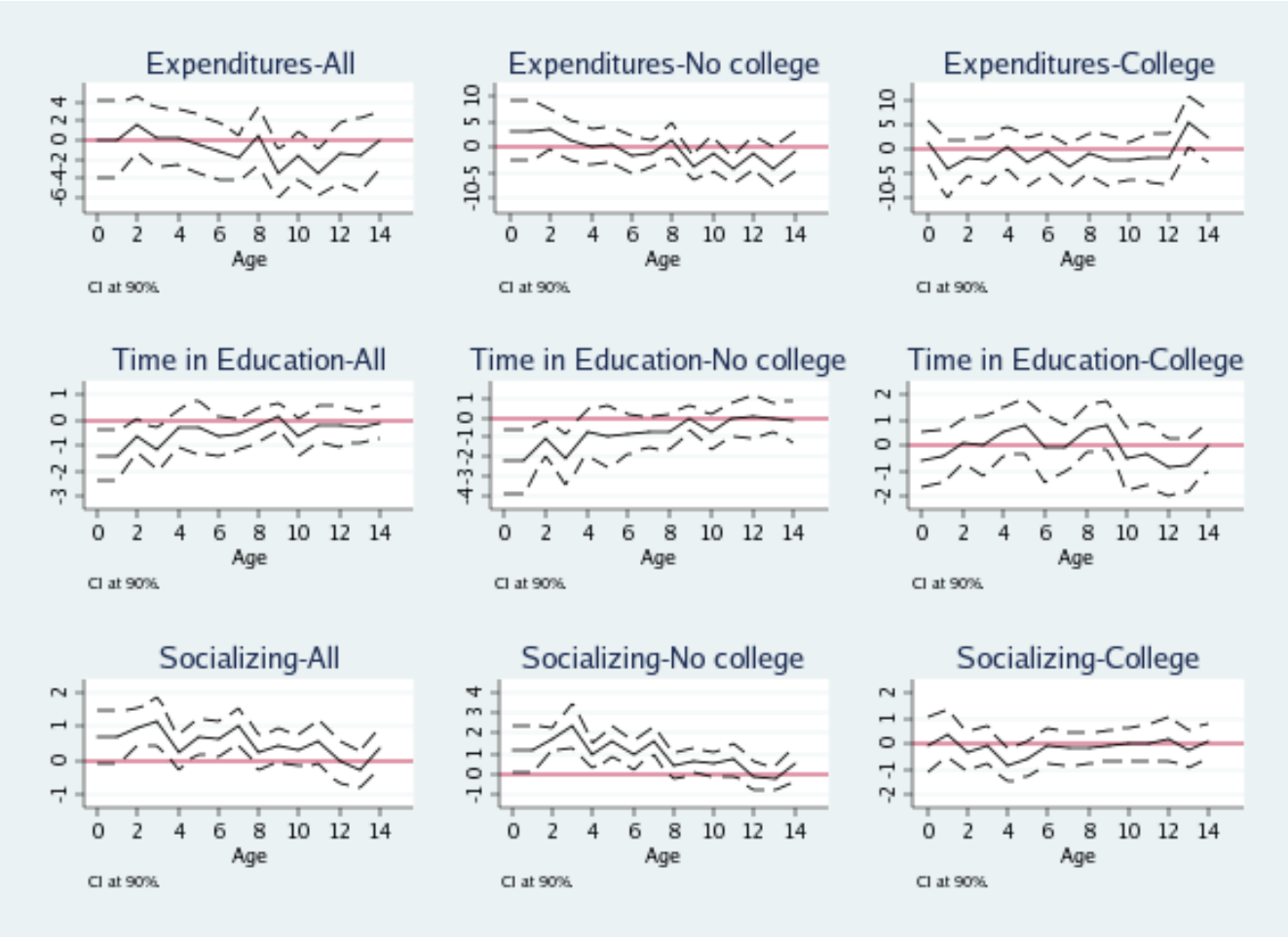



Figure 9 - Effect of shock on investments in human capital across child's life cycle (Data: CNLSY, unit: child)

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 $t$, $\varepsilon_{ct}$ 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, $\pi_k$ is a child fixed effect, $\pi_c$ is a county effect and $\pi_t$ are year fixed effects. The dependent variable in "Time in Education" and "Socializing" is $log(X + 1)$.

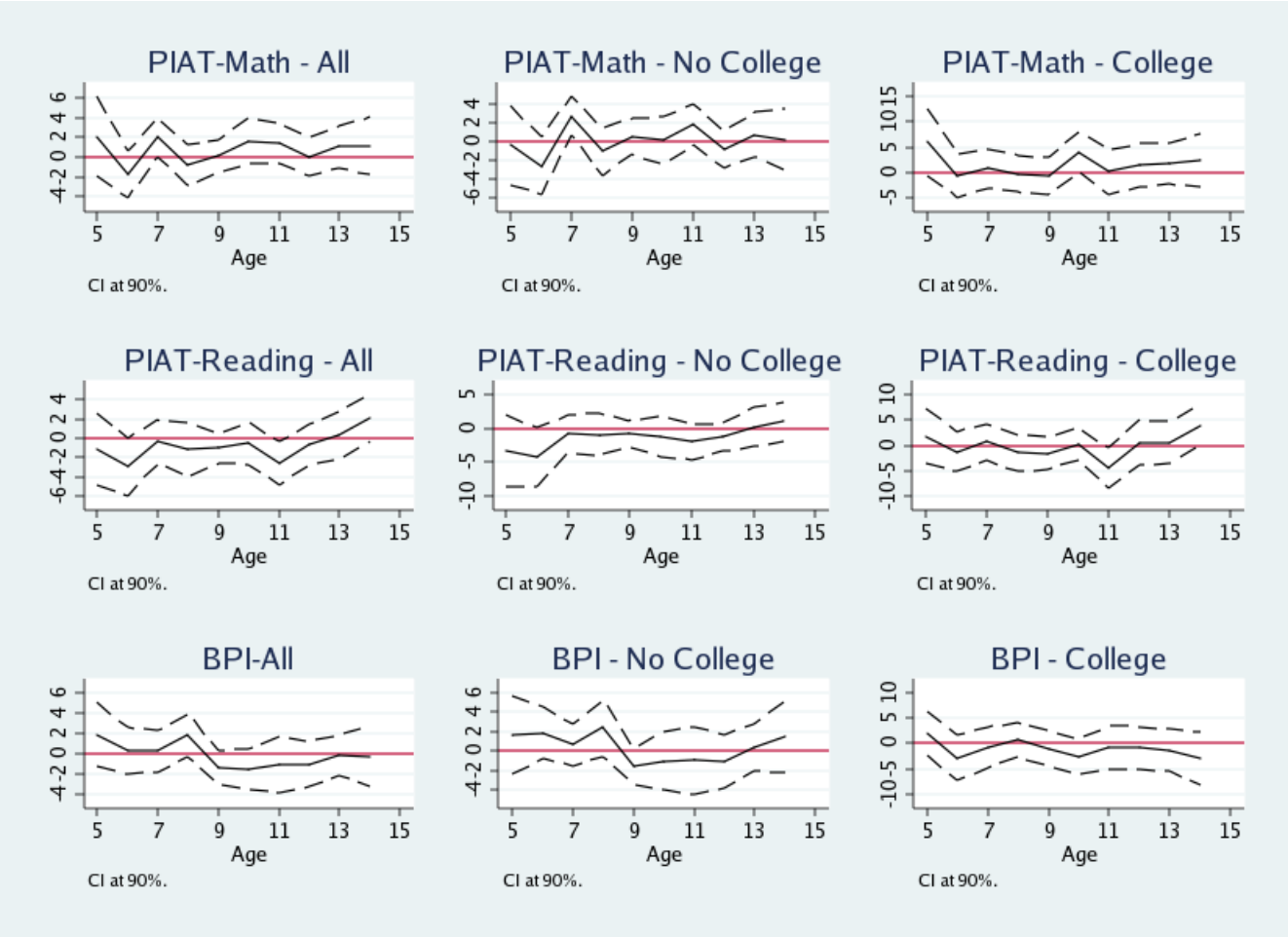



Figure 10 - Effect of shock on investments in human capital across child's life cycle (Data: CNLSY, unit: child)

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 $t$, $\varepsilon_{ct}$ 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, $\pi_k$ is a child fixed effect, $\pi_c$ is a county effect and $\pi_t$ 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

### Procedure to re-scale variables mismeasured in CNLSY

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 (they 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). 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 using 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 $\beta_0$ 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 variables observed in data set 1 and $X^*$ 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[1], 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 of data set 2 in which $(X_2^*, X_2, Z)$ are observed[2], 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 $f_{X_1}, f_{X_1^*}, f_{X_2}$ and $f_{X_2^*}$ be the marginal densities of the proxy variable and the latent variable in data sets 1 and 2; let $f_{X_1^*|X_1}$ and $f_{X_2^*|X_2}$ be the conditional densities of the latent variable given proxy variable in data sets 1 and 2, respectively. Let $E_1$ and $E_2$ denote the expectations taken in data set 1 and 2, respectively. 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 $\beta_0$ 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 $\beta$ and replace $X_1^*$ by the projection of $X_2^*$ on $X$, which are common to data sets 1 and 2.

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 is household expenditure on school tuition or how many minutes a day mother/father spent reading to children. Child level information can only directly be matched for one-child families. An inspection of within family variation in measures of parental

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

[2] The subscript on $X$s variables indicates the data set in which they are observed.

investment available in the CNLSY for families with more than one child[3] reveals that (i) some of these measures relate to family behaviors[4] and (ii) for those measures that are child specific there is little variation on mother's report.

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 recover family expenditure and time use 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] As CEX and ATUS contains household level measures of expenditures and time, I redefine indicators in NLSY at family level, by taking its mode within family. 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 to describe the relation between an aggregate expenditure/time allocation, $g_{ft}$, which is the sum of $M$ components. This aggregate is only available in CEX or ATUS and can be written as a function $h$ of $M$ indicators, $g^*_{mft}$, $m = 1, ..., M$, available in the CNLSY and CEX/ATUS for each family $f$ in year $t$, socio-economic and demographic characteristics and unobserved heterogeneity, $\varepsilon^g_{ft}$, which is assumed to have zero mean, $E[\varepsilon^g_{ft}|\mathbf{z}_{ft}] = 0$ :

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

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** Common variables indicating expenditures in CEX and NLSY are collected: the later contains only the mismeasured version, $g^*_{mft}$, CEX contains $g^*_{mft}$ and the true expenditure, $g_{ft}$ (annual expenditure). 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 NLSY 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.

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, 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, to whom the distribution in the NLSY79 is presented in columns (4), (6), (8) and (10) in Table A6. To create an indicator in CEX the correspondent threshold is set at the correspondent percentile of expenditure, whenever possible, or the indicator takes value 1 as long as expenditure in an item is above US$1 if the expenditure item does not have enough variation. In particular, 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, whereas "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 mismeasured indicators of expenditures, $g^*_{mft}$, is therefore very similar in both data sets.

To justify the parametric specification assumed for model (5), I start by plotting 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

[3] This analysis is available upon request.

[4] See Table A4 for variables that are child specific and family level investments.

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

[6] One can also expect complementarities in some types of expenditures. For example, Figure A2 suggests that expenditures in school tuition, child cloth and school are complements, suggesting that the number of school age children increases these type of expenditures, and economies of scale may be present if child's distribution of age are sufficiently close - econ.

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 re-scale expenditures observed in CNLSY.

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. Contrary to CEX, the ATUS has information on individuals' state of residence, and I exploit this regional variation in the model of imputation;

3. 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;

4. 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].

5. 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;

6. Parents spend a small proportion of daily time in primary child care activities[9]. Table A14 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. First, I recode all variables at the same time unit, in particular, activities in the CNLSY are recoded into 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?").

Second, as for CEX, I create an index of time in ATUS, which is a combination of several variables, say, $g^{*,T}_{1mft}$ and $g^{*,T}_{2mft}$. To simplify explanation, lets assume a linear specification, where $f$ is a parametric function:

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

Since measure $g^T_{ft}$ present a large proportion of zeros (see Column (1) - Table A14), this model is estimated by a Tobit. Therefore, to impute $g^T_{ft}$ in the CNLSY I compute

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

[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.

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].

**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. In particular, 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 $h$ of number of children gender $s$ and age $a$, $a = 0, ..., 14$ (14 is the oldest age to which I observe parental investments in NLSY79) 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 a dummy for $n$ 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. Therefore, effect of an extra child with gender $s$, $s = f, w$, and age $a$ is $\beta_{1as}$ (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 (check of reliability) | 0 | 269,667 | 11,051 |
| Drop children with less than 4 observ 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)

| | (1) Households | (2) |
|---|---|---|
| Sample | Dropped | 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 $\leq 14$ | 1041 | 23,557 |

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

| | (1) Households | (2) |
|---|---|---|
| Sample | Dropped | Remain |
| Original: households | | 72,922 |
| keep if age youngest child $\leq 14$ | 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 is recoded to 1 if takes value 1 or 2 and to 0 otherwise. | 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. |
| 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) | NLSY | 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: 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, triple interaction of indicator, number of children per household and mother's education. 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.
- 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.
- Specification (7) is the same as (6), but use only 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 obtained previously. 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 |
| Housework | Child expected to make bed | 6-14 | | Not specified |
| | Child expected to clean room | 6-14 | | Not specified |

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.

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

| Age of youngest child in household | | (1) All | (2) All | (3) 0-2 | (4) 0-2 | (5) 3-5 | (6) 3-5 | (7) 6-9 | (8) 6-9 | (9) 10-14 | (10) 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 |
| Housework | Mean | 0.35 | 0.68 | 0.37 | 0.63 | 0.39 | 0.64 | 0.43 | 0.67 | 0.27 | 0.75 |
| | SD | 0.48 | 0.47 | 0.48 | 0.48 | 0.49 | 0.48 | 0.50 | 0.47 | 0.44 | 0.43 |
| | N | 8307 | 10862 | 493 | 2255 | 1030 | 1547 | 2883 | 3826 | 3901 | 3234 |

Note: Comparison of original indicator variables of 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. Weekly (monthly) variables from NLSY are multiplied by probability of taking place in a given day (1/7 and 1/30, respectively).

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 |
| Recreational act. 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 | |
| Recreational act. 2 | Recreational act. 1 + socializing |
| Recreational act. 3 | Socializing + eating with parents |
| Recreational act. 4 | Socializing + exercise/sports + eating + preparation of meals |
| Recreational act. 5 | Socializing + exercise/sports + eating + tv |
| Recreational act. 6 | Socializing + exercise/sports + eating + preparation of meals + tv + entertainment not tv |
| Recreational act. 7 | Socializing + exercise/sports + eating + preparation of meals + tv + entertainment not tv + obtaining goods + housework |

Table A12 - Different measures for time allocation.

| | (1) Time leisure 1 Recreational Activities | (2) Time leisure 2 Col. (1) + Eating together | (3) Time leisure 3 Eating together +socializing | (4) Time leisure 4 Eating together +socializing +sports +prepare meals | (5) Time leisure 5 Eating together +socializing +sports +watch TV | (6) Time leisure 6 Eating together +social. + sports + watch TV +prep meals + entret. | (7) Time leisure 7 All time with children around, except during work | (8) Time teaching version 1 | (9) Time teaching version 2 |
|---|---|---|---|---|---|---|---|---|---|
| 1[Play with children] | 2.3643 | 0.4803 | | | | | | | |
| | [1.1152]** | [1.5825] | | | | | | | |
| 1[Arts and crafts with children] | 3.1193 | 0.4942 | | | | | | | |
| | [0.8711]*** | [0.7763] | | | | | | | |
| 1[Organizing care] | -4.9373 | -6.3077 | | | | | | | |
| | [4.3356] | [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] | | 0.425 | 2.9631 | 3.5865 | 7.2865 | 6.411 | 8.8542 | | |
| | | [0.4018] | [0.7566]*** | [1.2762]*** | [1.5065]*** | [1.9355]*** | [2.3844]*** | | |
| 1[Socializing] | | | 1.6982 | 3.1222 | -0.8361 | -1.3848 | 0.4056 | | |
| | | | [0.7390]** | [1.1420]*** | [1.2817] | [1.3156] | [1.6921] | | |
| 1[Exercise/sports with children] | | | | 4.5717 | 3.8541 | 5.0006 | 7.144 | | |
| | | | | [1.1625]*** | [1.4719]*** | [1.7539]*** | [2.1250]*** | | |
| 1[Watching TV with children] | | | | | 3.7805 | 4.1621 | 4.1111 | | |
| | | | | | [1.4083]*** | [1.6036]*** | [1.8910]** | | |
| 1[Preparing meals with children] | | | | 2.0254 | | 2.3215 | 1.4116 | | |
| | | | | [0.9456]** | | [1.2104]* | [1.5769] | | |
| 1[Entertainment] | | | | | | 7.064 | 6.6635 | | |
| | | | | | | [2.1287]*** | [3.0889]** | | |
| 1[Shopping] | | | | | | | 0.1983 | | |
| | | | | | | | [1.6952] | | |
| 1[Housework] | | | | | | | 1.4692 | | |
| | | | | | | | [1.7084] | | |
| Observations | 6261 | 6242 | 9196 | 6225 | 6229 | 6226 | 6229 | 4587 | 4583 |

Note: Regressors excluded from table include 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 (8) and (9) use a smaller sample because include variable "mother reads to child" so that only sample of mothers is used.

Table A13 - Distribution of original and imputed time use variables.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Panel A | | | | | | | |
| | Time teaching 1 | | Time teaching 2 | | Time leisure 2 | | Time leisure 3 | |
| | Original | Imputed | Original | Imputed | Original | Imputed | Original | Imputed |
| N | 9398 | 16344 | 9398 | 16344 | 9398 | 16344 | 9398 | 16344 |
| mean | 0.25 | 1.14 | 0.48 | 1.35 | 1.56 | 1.69 | 1.68 | 5.31 |
| sd | 0.62 | 0.69 | 0.89 | 0.92 | 1.37 | 0.67 | 1.96 | 1.9 |
| percentile 25 | 0 | 0.65 | 0 | 0.65 | 0.67 | 1.31 | 0.25 | 3.43 |
| percentile 50 | 0 | 1.04 | 0 | 1.13 | 1.25 | 1.61 | 1.08 | 6.73 |
| percentile 75 | 0.17 | 1.49 | 0.67 | 1.91 | 2 | 1.97 | 2.33 | 6.87 |
| percentile 95 | 1.5 | 2.45 | 2.17 | 3.12 | 4.22 | 2.65 | 5.65 | 6.95 |
| | Panel B | | | | | | | |
| | Time leisure 4 | | Time leisure 5 | | Time leisure 6 | | Time leisure 7 | |
| | Original | Imputed | Original | Imputed | Original | Imputed | Original | Imputed |
| N | 9398 | 16344 | 9398 | 16344 | 9398 | 16344 | 9398 | 16344 |
| mean | 2.51 | 6.76 | 3.39 | 5.39 | 4.15 | 7.65 | 5.38 | 7.42 |
| sd | 2.51 | 3.09 | 3.12 | 1.35 | 3.48 | 1.19 | 4.3 | 1.1 |
| percentile 25 | 0.5 | 4.25 | 0.67 | 4.54 | 1.08 | 7.92 | 1.5 | 7.3 |
| percentile 50 | 2 | 6.86 | 2.92 | 5.12 | 3.8 | 8.01 | 5 | 7.4 |
| percentile 75 | 3.75 | 8.9 | 5.17 | 6.18 | 6.33 | 8.17 | 8.58 | 7.7 |
| percentile 95 | 7.4 | 11.91 | 9.33 | 7.59 | 10.55 | 8.84 | 12.88 | 9.42 |

Note: Original distribution of time use from the entire sample within cohort 1955-1965 of ATUS 2003-2007 vs correspondent variables imputed in the CNLSY (only representative subsample). Unit of observation in the CNLSY: family. Measures in hours per day.

Table A14 - 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.

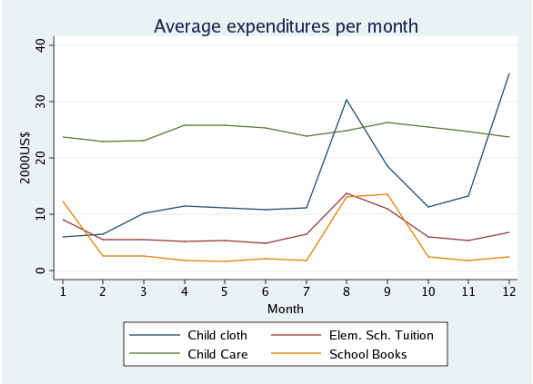
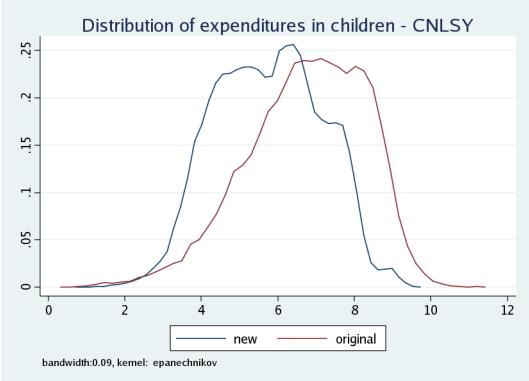
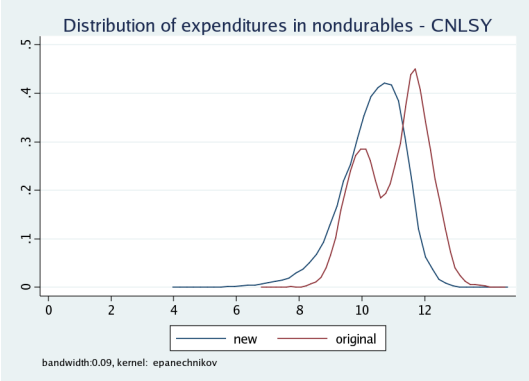
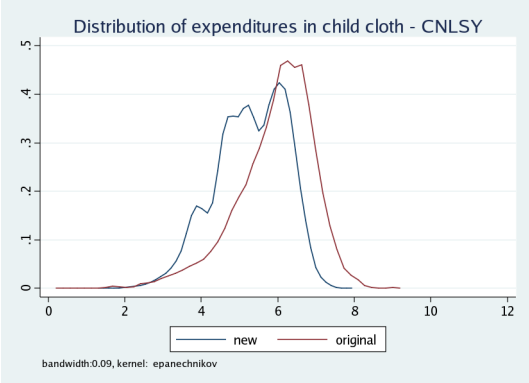



Figure A2 - Comparison of distribution of original and imputed expenditures (Data: CEX 1980-2000 and CNLSY 1986-2006).




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 was, salary, commissions, or tips from all jobs, before deductions for taxes or anything else. If annual wages are missing and annual hours worked and hourly wage is available I use this information to compute the respondent annual wage.

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

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, partners, boarders, guardians, and other non-relatives are considered nonfamily members for the purposes of this variable. As original definition available in NLSY79 excludes income of partners are excluded, I construct a corrected measure of family income that includes partner's income.

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

5. **Welfare income** includes total amount of AFDC/TANF, Food Stamps, SSI/other public assistance income respondent or spouse received.

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 Worth** created by summing all asset values and subtracting 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, giving 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 $t$.

**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) family size (using number of children and mother's marital status), and (iii) mother's marital status, using information available in adjacent years and on whether an individual ever married as of year $t$. 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 current enrolment available in CNLSY on 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 so-called 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. As CEX is matched with NLSY79, I keep 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.

[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 in sample to perform imputation.

### 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.

### 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 | -0.348 | -3.849 | -0.633 | -0.348 | 0.087 | 0.485 | 0.059 | 1.987 | 1.203 |
| | [0.239] | [1.604]** | [0.453] | [0.418] | [1.752] | [0.682] | [0.249] | [2.045] | [0.975] |
| Shock in tX1[HS degree or less] | | | | -0.122 | -7.628 | -2.163 | -0.413 | -6.872 | -2.396 |
| | | | | [0.512] | [3.273]** | [0.940]** | [0.314] | [2.805]** | [1.211]** |
| Observations | 32061 | 32061 | 32061 | 16709 | 16709 | 16709 | 15352 | 15352 | 15352 |
| Number of mothers | 5164 | 5164 | 5164 | 2580 | 2580 | 2580 | 2584 | 2584 | 2584 |
| Effect of 1pp increase in unemployment | | | | | | | | | |
| All | -0.348 | -233.37 | -151.04 | | | | | | |
| High Euducation | | | | -0.348 | 3.36 | 107.90 | 0.059 | 384.31 | 307.86 |
| Low Education | | | | -0.47 | -291.54 | -373.32 | -0.354 | -944.82 | -305.30 |
| P-Values | | | | | | | | | |
| H0: HS degree/dropout = 0 | | | | 0.30 | 0.01 | 0.02 | 0.12 | 0.01 | 0.20 |
| H0: Joint test on Shock in t | | | | 0.50 | 0.01 | 0.04 | 0.27 | 0.02 | 0.14 |
| Mean | 0.85 | 8.71 | 10.08 | 0.79 | 8.26 | 10.01 | 0.92 | 9.87 | 10.15 |
| SD | 0.36 | 1.34 | 1.19 | 0.41 | 1.39 | 1.19 | 0.27 | 1.29 | 1.20 |
| Mean (2000US$) | | 6063.24 | 23860.99 | | 3866.09 | 22247.84 | | 19341.34 | 25591.10 |
| % of observations without earnings | | 2.87% | | | 15.18% | | | 6.81% | |

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

| Dependent variable | (1) Participation | (2) | (3) Log family earnings | (4) Log family income | (5) Participation | (6) Log family earnings | (7) Log family income |
|---|---|---|---|---|---|---|---|
| | Woman | Spouse | | | | | |
| Sample | Married | | | | Single | | |
| Shock in t | 0.161 | -0.479 | -0.768 | -1.834 | -2.574 | -5.093 | -1.599 |
| | [0.509] | [0.425] | [0.692] | [0.875]** | [1.261]** | [2.909]* | [2.318] |
| Shock in tX1[HS degree or less] | -0.776 | 0.059 | -0.23 | 0.357 | 0.982 | 1.794 | 4.023 |
| | [0.663] | [0.605] | [0.831] | [1.414] | [1.426] | [3.352] | [2.969] |
| Observations | 9658 | 9658 | 9658 | 9658 | 3569 | 3569 | 3569 |
| Number of mothers | | | | | | | |
| P-Values | | | | | | | |
| H0: HS degree/dropout = 0 | 0.16 | 0.22 | 0.01 | 0.13 | 0.02 | 0.03 | 0.11 |
| H0: Joint test on Shock in t | 0.34 | 0.17 | 0.01 | 0.02 | 0.01 | 0.01 | 0.26 |

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 (3) and (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%.

**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 cloth | | 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)