Economics of Child Well-Being

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Gabriella Conti and James J. Heckman

14.1 Introduction

There is a growing interest in the well-being of children. Such interest is supported by recent evidence from both the biological and the social sciences, which points to the importance of the early years in shaping the capabilities that promote well-being across the life course (Knudsen et al. 2006). It is now recognized that human development is a dynamic process that starts in the womb. Capabilities interact synergistically to create who we are and what we become. The foundations for adult success and failure are laid down early in life. Children raised in disadvantaged environments start behind and usually stay behind throughout their lifetimes. Gaps in cognitive and behavioral traits emerge very early. The risk of disease increases more rapidly with age in disadvantaged populations. Inequality among families in

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G. Conti (✉)
Harris School of Public Policy Studies, University of Chicago, Chicago, IL, USA
e-mail: gconti@uchicago.edu

J.J. Heckman
Department of Economics, University of Chicago, Chicago, IL, USA

University College Dublin, Dublin, Ireland

American Bar Foundation, Chicago, IL, USA
e-mail: jjh@uchicago.edu; jheckman@uchicago.edu

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early childhood environments is a major producer of inequality in the capabilities that promote successful functioning in society. In the absence of interventions to alter their trajectories, children growing up in disadvantage are at increasing risk – both socioeconomic and biological. These observations are highly relevant in light of the evidence that families are under stress. By many measures, the early-life environments of a large swathe of children have declined in recent decades (McLanahan 2004; Heckman 2008).

Prevention is more cost-effective than remediation. As implemented, most adolescent and adult remediation programs are ineffective (see Cunha et al. 2006) and have much lower returns than early childhood programs that prevent problems before they occur. The message of this chapter is that high-quality early interventions that alter early-life conditions are effective ways to promote well-being and human flourishing across the life cycle.

Key to this analysis is a concept of child well-being recently developed in economics (Cunha and Heckman 2007; Heckman 2007). It envisions a core set of capabilities as capacities to function, including cognition, personality, and biology. This approach views the child in her entirety as a human being *in fieri* – as a work in progress. This notion is embedded in a life-cycle framework of human development that distinguishes the determinants of child well-being that can be manipulated by policy, from the measurements that proxy the underlying traits that generate outcomes, and the outcomes themselves. In order to develop effective policies, it is important to understand the various aspects of child well-being and their causes and consequences. We need to understand the capabilities and mechanisms that produce success across multiple dimensions of human activity, including crime, earnings, physical and mental health, and education. Linking the capabilities acquired in the early years to a variety of adult outcomes and understanding the channels through which early-life conditions affect them enhance our understanding of human development. A strategy of early prevention – rather than adult and adolescent remediation – promotes well-being from childhood into advanced old age.

This chapter is structured along the following lines. Section 14.2 discusses the indicators used for measuring child well-being in international studies. We review the early work on the economic approach to child well-being in Sect. 14.3. We present the recent developmental approach in Sect. 14.4. Recent empirical findings are summarized in Sect. 14.5. Section 14.6 presents evidence from interventions that promote child well-being. Section 14.7 concludes and offers some suggestions for future research.

14.2 What is Child Well-Being?

While the notion of well-being has been promoted by the World Health Organization since 1948, there is still little consensus as to how it should be measured ("Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." WHO, Preamble to the Constitution of

the World Health Organization as adopted by the International Health Conference, New York, June 19–22 1946 and entered into force on April 7 1948). This is partly because research has tended to divide into two different interpretations of what is meant by well-being (Ryan and Deci 2001a). The hedonic viewpoint (Kahneman et al. 1999) focuses on subjective well-being or happiness and is usually defined in terms of avoidance of pain and attainment of pleasure. The eudaimonic viewpoint, instead, focuses on psychological well-being, defined more broadly to incorporate dynamic processes such as self-realization and the degree to which a person is fully functioning in society (Ryff and Singer 1998). The latter is the approach adopted in the recent literature in economics (Sen 1999; Cunha and Heckman 2007, 2008, 2009) and the point of view of this chapter.

Recent years have witnessed a steady increase in the efforts to measure and monitor the status of children [See Ben-Arieh (2008) for a summary of the history and development of the field]. The trend has been to move away from an exclusive focus on composite indices of poverty or deprivation toward indicators encompassing multiple dimensions of child well-being. However, as noted in Ben-Arieh and Frones (2011), despite the development of numerous "indicators" of child well-being, the field is fragmented and lacks a unifying taxonomy. We present as examples two indicators of child well-being used at the international level and discuss their structure and economic content. We refer the interested reader to the survey by Fernandes et al. (2011) for a review and comparison of four distinct approaches to measuring child well-being – those by Land et al. (2007), by Bradshaw and Richardson (2009), by Moore et al. (2013), and Bastos and Machado.

UNICEF (2007) considers six different dimensions of child well-being (each dimension can have multiple components and each component multiple indicators. Before the 2007 report, income poverty was used as a proxy measure for overall child well-being):

1. Material well-being: % of children living in relative income poverty, in households without jobs, and in reported deprivation (in terms of low family affluence, few educational resources, and fewer than ten books at home).
2. Health and safety: health at age 0–1 (mortality and low birth weight), preventative health services (immunizations against measles, DPT, and polio), and safety (deaths from accidents and injuries).
3. Educational well-being: school achievement at age 15 (average achievement in reading, mathematical, and science literacy), beyond basics (% of those age 15–19 staying in education), and transition to employment (% of those age 15–19 not in education, employment, or training or expecting to find low-skilled work).
4. Family and peer relationship: family structure (% of children living in single-parent families or stepfamilies), family relationships (% of children reporting eating the main meal with parents more than once per week, % of children reporting parents spend time "just talking" to them), and peer relationships (% of children reporting their peers to be "kind and helpful").
5. Behaviors and risks: health behaviors (% of children who eat breakfast/fruit daily and are physically active or overweight), risk behaviors (% of children who smoke/have been drunk more than twice/use cannabis/have sex by 15/use condoms and teenage

fertility rate), and experience of violence (% of children involved in fighting in last 12 months and reporting being bullied).

6. Subjective well-being: health (% of children rating their health no more than "fair" or "poor"), school life (% of children "liking school a lot"), and personal well-being (% of children rating themselves above the midpoint of a "Life Satisfaction Scale" and % of children reporting negatively about personal well-being. Young children are asked to agree or disagree with three statements about themselves: "I feel like an outsider or left out of things," "I feel awkward and out of place," and "I feel lonely").

In a study based on data from 23 rich countries, this index was shown to be negatively correlated with income inequality and the proportion of children in relative poverty (Pickett and Wilkinson 2007).

These indicators cover a wide array of aspects related to child development. Yet they are unsatisfactory in at least two respects. First, no clear distinction is made among proxies of underlying well-being (e.g., self-reported health, birth weight), inputs amenable to interventions (e.g., parenting time and quality), and outcomes (e.g., education and health behaviors), which are a function of both previous components. Second, no temporal, developmental distinction is made. Components of these indices related to different stages of childhood are lumped together, without any regard to the timing of measurements and investments, and with little importance given to the prenatal period and the early years.

These serious shortcomings are being addressed in indices currently being developed. For example, the Index currently being developed by UNESCO, the *Holistic Early Childhood Development Index* (HECDI), scheduled to be delivered in 2013, will cover child development from antenatal life to 8 years of age. The fact that these indicators have scope for improvement is noticed in the UNICEF report:

> No single dimension of well-being stands as a reliable proxy for child well-being as a whole and several OECD countries find themselves with widely differing rankings for different dimensions of child well-being (p. 3). (The United Kingdom and the United States find themselves in the bottom third of the rankings for five of the six dimensions reviewed. European countries dominate the top half of the overall league table, with Northern European countries claiming the top four places).

The framework presented in Sect. 14.4 places each of the components used to define the UNICEF indicators in a life-cycle developmental perspective. This framework clearly distinguishes which indicators measure which aspects of human development and flourishing, what factors are amenable to policy intervention, which are the mechanisms producing capabilities, and how to evaluate different policies to promote child well-being.

Child well-being is also high on the policy agenda of the OECD (2009), which has also produced a framework including outcome indicators with the following six dimensions:

1. Material well-being: average disposable income, children in poor homes, and educational deprivation.
2. Housing and environment: overcrowding and poor environmental conditions.

3. Educational well-being: average mean literacy score, literacy inequality, and youth NEET (not in education, employment, or training) rates.
4. Health and safety: infant mortality, low birth weight, breastfeeding rates, vaccination rates, physical activity, and suicide rates.
5. Risk behaviors: smoking, drunkenness, and teenage births.
6. Quality of school life: bullying and school enjoyment.

Neither set of indices distinguishes among indicators, inputs, and outcomes, a common problem. The OECD indicators do not include either subjective well-being or the child's relationship with parents. Additionally, measures of early cognitive development and mental health are not included (One exception to this is the case of Australia, where, based on research and consultation, the *Strengths and Difficulties Questionnaire* (SDQ) was strongly supported as the most appropriate tool for measuring social and emotional well-being in children. It has been recommended that a Children's Headline Indicator for social and emotional well-being be defined as the proportion of children scoring "of concern" on the *Strengths and Difficulties Questionnaire*, since this instrument has been extensively validated and is widely used).

Indices of child well-being have also been developed by individual countries. For the United States, a comprehensive composite state-level index of child well-being is the Foundation for Child Development's (FCD) *Child Well-Being Index* (CWI) (O'Hare et al. 2012), which is updated annually and describes how young people in the United States have fared since 1975. It is the nation's most comprehensive measure of trends in the quality of life of children and youth. It combines national data from 28 indicators across seven domains (family economic well-being, health, safe/risky behavior, educational attainment, community engagement, social relationships, emotional/spiritual well-being) into a single index that reflects overall child well-being. The index is used to inform policymakers and the public on how well children are doing. It was created to provide a broader measure of children's quality of life not captured by GDP, which only measures income. In the United Kingdom, the National Statistician recently convened a Well-being Forum (Office for National Statistics 2011); the respondents to the public consultation identified the well-being of the children as an area of particular concern. Subsequently, the Office for National Statistics formed a working group to develop and assess measurement of well-being for this age group (Beaumont 2011). They concluded that satisfactory indices must measure children's well-being as a multifaceted concept which considers the many areas that affect their well-being at different ages. In the first year of work, the ONS launched a consultation on a first set of domains and measures of national well-being. An updated list has just been published (ONS 2012) and currently includes a list of ten domains: individual well-being, our relationships, health, what we do, where we live, personal finance, education and skills, the economy, governance, and the natural environment), each of them comprising between three and five measures (for example, the health domain includes four measures: healthy life expectancy at birth; percentage who report a long-term illness and a disability; percentage who were somewhat, mostly or completely satisfied with their health; and percentage with probable psychological disturbance or ill mental health).

14.3 Child Well-Being in the Early Literature of Economics

Theoretical Literature on Child Well-Being. While improving child well-being is an important social goal, past theoretical literature in economics has largely focused on the human capital of the child. This is usually related to its earnings potential. The basic idea is that a household maximizes its utility, which has a measure of child quality as one of its inputs. This concept of quality encompasses the various skills that the child develops under the care and investment of its parents – skills which later contribute to its adult socioeconomic success.

A pioneering study of the role of the family in shaping child outcomes is Leibowitz (1974). The author notes that by the time children enter first grade, there are significant differences among them in terms of verbal and mathematical competence, which reflect variations in both inherent ability and the amount of human capital acquired before school entry. These stocks of acquired human capital reflect, in turn, different inputs, in terms of both time and other resources, by parents, teachers, siblings, and the child herself. The author compares the process of acquiring preschool human capital to the acquisition of human capital through schooling or on-the-job training. She applies a version of the Ben-Porath (1967) model of human capital accumulation, a model of on-the-job investment in human capital, to explain investment in children. In her empirical analysis, she uses the endowments of the mother as proxies for parental investment in children. The model does not consider life-cycle dynamics of the child.

The paper by Becker and Tomes (1986) is a seminal contribution in the economics literature. The authors develop a one-period-of-childhood model of the transmission of economic status from parents to children. They identify the forces that determine intergenerational income mobility and offer explanations for the channels of intergenerational transmission of status. Their model assumes that the parents maximize their own utility and are concerned about their own consumption and the *adult* utility of their children. They feature parental altruism toward the child under different assumptions about the ability of parents to borrow against the child's future income. As part of their analysis, they consider parental investment in child skills.

Since theirs is a one-period model of childhood, they do not make an early-late childhood distinction that is a crucial feature of recent research on child development reviewed in Sect. 14.4. Additionally, they assume unidimensionality of child skills, corresponding to "general human capital," and do not distinguish among the different components of child well-being (e.g., cognition, personality, health). They also assume that the initial endowments of the child are not affected by parental investments. While including the adult utility of the child as an input into parental utility sounds like directly modeling the child's well-being, they ignore the well-being of the child as a child. The only way that a parent can increase the utility derived from that of a child is to invest in her human capital (which directly increases her adult earnings) or to leave bequests. Thus, the focus in this research is on increasing adult earnings and adult wealth.

Each generation of children inherits biological and cultural endowments from their parents. However, the heritability of these endowments is less than perfect. This implies that endowments regress to the mean. Children with well-endowed parents tend to have above-average endowments but, on average, less than those of the parents, whereas children with poorly endowed parents tend to have below-average endowments that on average are larger relative to their parents' levels. Parents not only pass on their endowments but also influence the adult earnings of their children via investments in human capital. As a result, adult human capital and earnings are determined by endowments, parental investments, and bequests, as well as by public expenditures.

The authors analyze the two cases of "perfect" and "imperfect" capital markets. In the analysis of perfect capital markets, parents can borrow against the future income of the child to finance investments in children. These debts are allowed to become the obligations of children when they become adults. Parents borrow to finance expenditures on their children's human capital up to a point where the rate of return to human capital (the annual yield on investment) equals the market interest rate. An important implication of the model with perfect credit markets is that, for a given inherited ability level, the child's level of human capital and labor earnings would be independent of their parents' asset and earnings because poor parents can always borrow against their child's earnings to finance investment expenditures. Rich parents leave more bequests. Hence, for the same level of ability, the income of children from wealthier families will be higher solely because of these bequests. In the case of imperfect capital markets, parents cannot borrow against the future earnings of the child. Instead, they have to reduce their personal consumptions to finance private expenditures on children. In imperfect capital markets, parental investments in children and consumptions are reduced if borrowing constraints are binding. This reduces the earnings of poor children when they are adults, so their adult incomes are lower for two reasons: (a) lower bequests and (b) lower human capital.

Empirical Literature on Child Well-Being. Consistent with the terminology used in the theoretical literature, there are very few studies which explicitly mention child well-being as their object of investigation in the empirical literature in economics. [On the other hand, there is an expanding economic literature on subjective well-being in adults; see, e.g., Dolan et al. (2011)]. When this is the case, the focus of this work is usually on the effect of welfare policies (Grogger and Karoly 2007) and income and family structure (Evenhouse and Reilly 2004). We defer discussion of the empirical evidence to Sect. 14.5. Here, we refer the reader to recent surveys which provide comprehensive reviews of the economic evidence on different aspects of child well-being: parental investments and child development (Cunha et al. 2006); parental socioeconomic status, child health, and adult success (Currie 2009); family background and intergenerational transmission (Bjorklund and Salvanes 2011); and early-life conditions (Almond and Currie 2010).

Availability of Data. We next consider the availability of data to study child well-being and its long-term consequences. US-based research is hampered by the

fact that few datasets contain extensive longitudinal information on all parts of the life cycle. As a rule, many US data sources cover the late part of the life cycle and collect retrospective information on early childhood circumstances, as in the case of the MIDUS (Midlife in the United States), PSID (Panel Study of Income Dynamics), and WLS (Wisconsin Longitudinal Study). Some cover the transition from late childhood/adolescence to adulthood (again, with some retrospective information), as in the case of the National Longitudinal Study of Adolescent Health (AddHealth) and of the two National Longitudinal Surveys of Youth (NLSY79 and NLSY97). Others cover a substantial portion of the childhood, but with no later-life follow-up: the Child Development Supplement of the Panel Study of Income Dynamics (CDS-PSID), the Children of the National Longitudinal Survey of Youth 1979 (CNLSY79), the two Early Childhood Longitudinal Studies – Birth Cohort (ECLS-B) and Kindergarten Cohort (ECLS-K) – the Study of Early Child Care and Youth Development (NICHD-SECCYD) and the Fragile Families and Child Wellbeing Study. In the United Kingdom, life course research has a long tradition. Several cohort studies have been started in the past 50 years: in 1946 (the National Survey of Health and Development), in 1958 (the National Child Development Study), in 1970 (the British Cohort Study), and in 2000 (the Millennium Cohort Study). Another valuable resource available to researchers is the ALSPAC (Avon Longitudinal Study of Parents and Children), a cohort study of children born in the former county of Avon (England) during 1991 and 1992.

14.4 Conceptualizing Child Well-Being and Its Development Within an Integrated Developmental Framework

This section presents the developmental approach to child well-being. It reviews the work in Cunha and Heckman (2007) and Heckman (2007) and extensions. This approach is distinct from both the traditional approach in economics, which focuses on specific aspects of child well-being, and from the various interdisciplinary attempts to construct summary measures, which lack any underlying theory and so do not distinguish between observable indicators of child well-being and the determinants that causally affect it (e.g., household income or the quality of parenting) – and which can be changed by policy.

As compared to the previous literature, this approach has several features:

1. It is guided by an integrated theoretical framework – a life-cycle approach to the origins and development of the capabilities that promote well-being across the life cycle – that allows focus on specific stages and intergenerational transmission mechanisms.
2. It clearly distinguishes indicators (measurements) of child well-being from their causes/determinants (inputs) and consequences/outcomes (output), hence providing guidance for policy.
3. It inherently deals with the complexity of the issue at hand, by allowing for child well-being to be multidimensional (composed of capabilities of different nature).

4. It facilitates investigation of the mechanisms through which child well-being shapes adult outcomes, the possibilities of remediation for adverse early-life experiences, the extent to which intervening factors can alter life course trajectories, and the timing when they operate.

The last point is particularly important. Understanding the multiple channels of influence in promoting human capabilities allows analysts and governments to compare and prioritize alternative policies over the life cycle.

Before describing the framework, we present some evidence that gaps in child capabilities by family environments emerge very early. Figure 14.1 shows the proportion of children born with low birth weight (weight at birth less than 2,500 g) in two British cohorts born in 1958 (National Child Development Study, NCDS) and in 1970 (British Cohort Study, BCS), respectively. For both cohorts and genders, we observe a clear SES/health gradient, where children born in more disadvantaged households have almost twice the chance of being born with a low birth weight as compared to those born in more affluent families. While inequality in family environments is already present at birth, it becomes amplified throughout childhood. Children born in disadvantaged families not only start off in worse initial conditions but also receive less investment from the early years of their lives. Evidence on this latter point is presented in Fig. 14.2, where we see that, at age 5, children raised in families of low SES are read to on average two days less per week than children born in more advantaged environments.

Given these mechanisms, in the absence of interventions, inequalities present at birth can get under the skin and affect the biology of the child, propagate throughout childhood, and persist into adulthood. In Fig. 14.3, we see evidence of a gradient in C-reactive protein (an inflammatory marker associated with a variety of cardiovascular risk factors) at age 44, by social class at birth, which mimics the gradient in low birth weight seen in Fig. 14.1.

Such complex evidence needs to be conceptualized and interpreted within a life-cycle framework linking early-life conditions to late-life outcomes by accounting for intervening mechanisms and a variety of exposures at different levels.

The framework proposed in this chapter is based on Cunha and Heckman (2007, 2008, 2009), Cunha, Heckman, and Schennach (2010), and Heckman (2007), who build a model of human development with four main ingredients: (a) a measurement framework showing how capabilities causally affect a variety of child and adult outcomes; (b) a dynamic framework (the "technology of capability formation") characterizing how environments and investments joined with stocks of capabilities affect the evolution of capabilities; (c) the preferences of the parents which help shape the investments in skills; and (d) the constraints that the families face, reflecting both access to credit markets and the availability of time. In the following we focus on the first two aspects, since parental preferences are not yet well understood (see, however, Del Boca, Flinn, and Wiswall 2011), and the strength of the other constraints depends on the level of development of the institutions in a particular society.

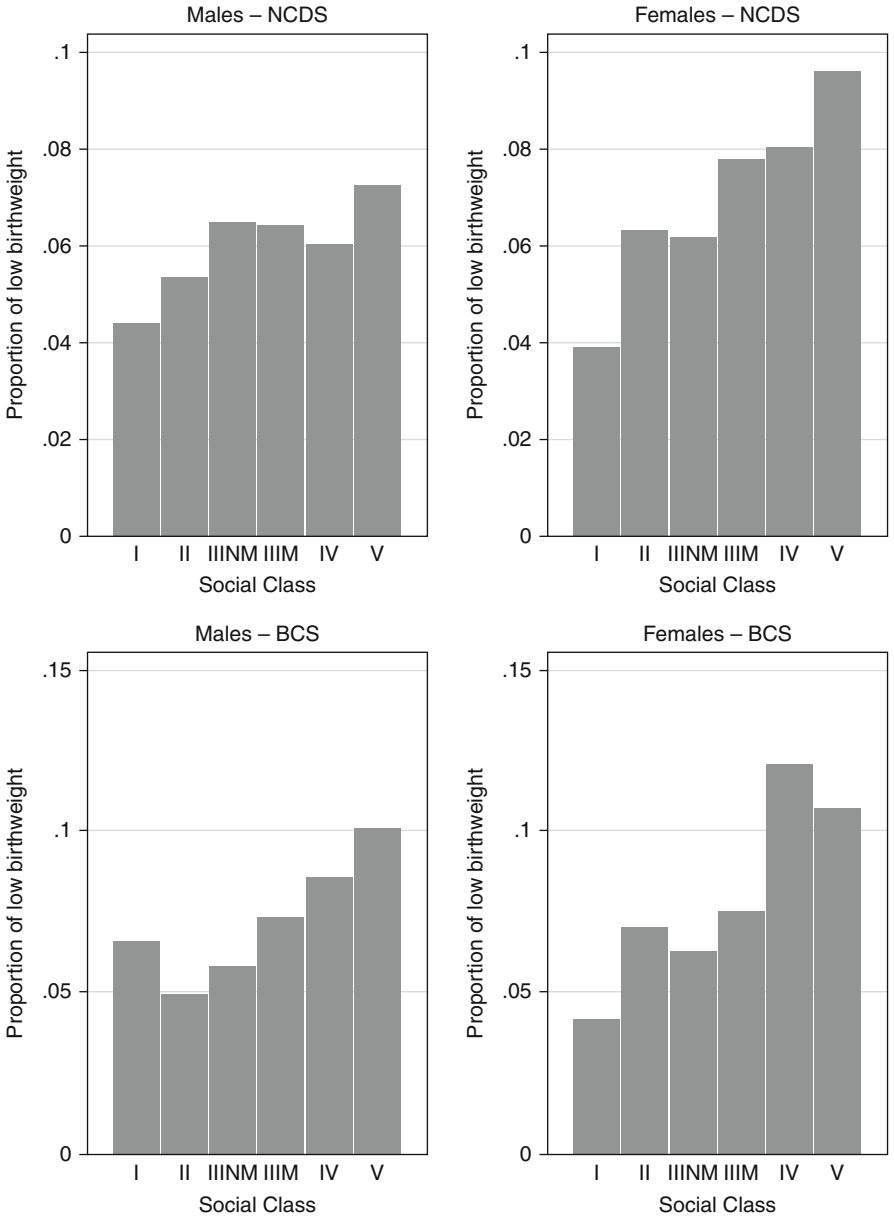

Fig. 14.1 Low birth weight by gender and social class (Source: Own calculations based on NCDS and BCS data). Note: The labels to the bars refer to the social class at birth of the mother's husband for the NCDS and of the father for the BCS. Both these data use the Registrar General's Classification of Social Class (SC): Social Class I (*I*) includes professional occupations, Social Class II (*II*) includes managerial and technical occupations, Social Class IIINM (*IIINM*) includes skilled nonmanual occupations, Social Class IIIM (*IIIM*) includes skilled manual occupations, Social Class IV (*IV*) includes partly skilled occupations, and Social Class V (*V*) includes unskilled occupations

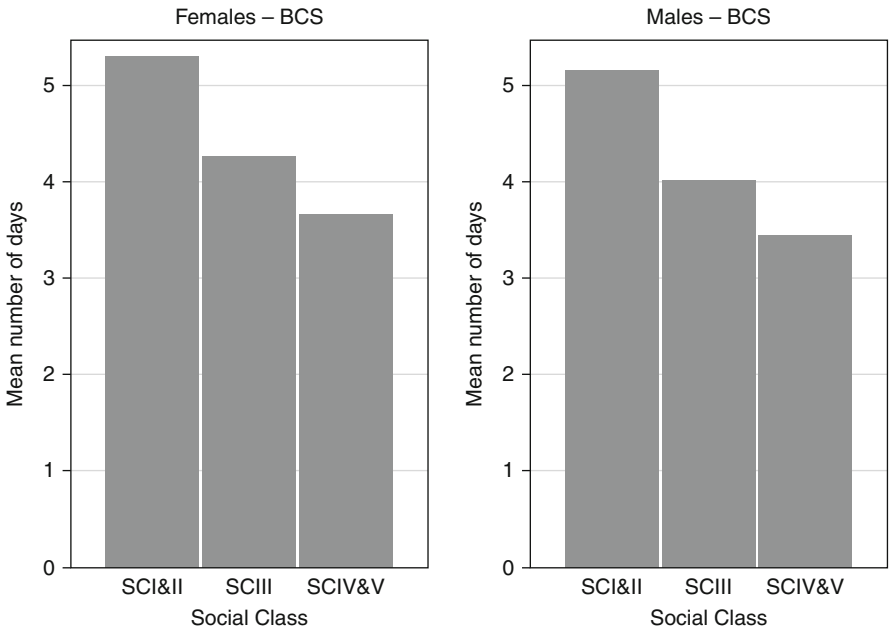

Fig. 14.2 Number of days the child is read to in last week by gender and social class (Source: Own calculations based on BCS data). Note: The labels to the bars refer to the social class of the father at age 5. The BCS uses the Registrar General's Classification of Social Class (*SC*): Social Class I (*SCI*) includes professional occupations, Social Class II (*SCII*) includes managerial and technical occupations, Social Class III (*SCIII*) includes skilled nonmanual and manual occupations, Social Class IV (*SCIV*) includes partly skilled occupations, and Social Class V (*SCV*) includes unskilled occupations

(a) The first component of the framework is the outcome $k \in \{1, \ldots, K_t\}$ at age t $\left(Y_t^k\right)$ which is the output of child well-being – for example, an educational qualification or a risky behavior. The outcomes are generated in part by a vector of capabilities at age t, denoted as θ_t, which constitute the different dimensions of child well-being. The dimensionality of the vector θ_t does not have to be specified *a priori* by the researcher. However, in the following we simplify the discussion and consider it as a three-dimensional object $\theta_t = \left(\theta_t^C, \theta_t^N, \theta_t^H\right)$ where θ_t^C denotes a vector of cognitive capabilities, θ_t^N is a vector of noncognitive or personality traits, and θ_t^H is a vector of health capacities. Each component can be further characterized by several dimensions, e.g., fluid and crystallized intelligence for cognition, the Big Five for personality, and mental and physical health. Outcome k at age t $\left(Y_t^k\right)$ is thus generated as a function of capabilities and effort:

Equation 14.1. Outcomes

$$Y_t^k = \psi^k\left(\theta_t^C, \theta_t^N, \theta_t^H, e_t^k\right) \tag{14.1}$$

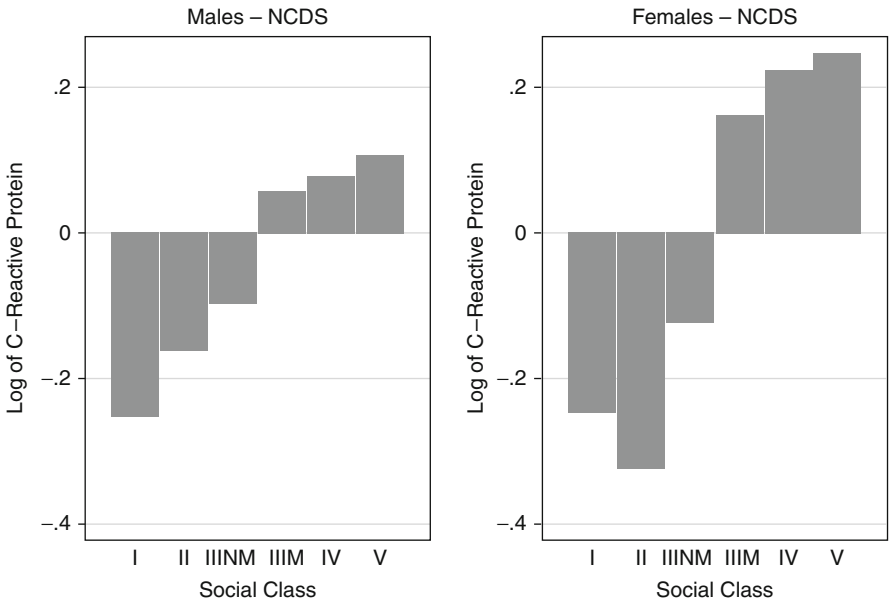

Fig. 14.3 Log of C-reactive protein by gender and social class at birth (Source: Own calculations based on NCDS data). Note: The labels to the bars refer to the social class at birth. The NCDS uses the Registrar General's Classification of Social Class (*SC*): Social Class I (*I*) includes professional occupations, Social Class II (*II*) includes managerial and technical occupations, Social Class IIINM (*IIINM*) includes skilled nonmanual occupations, Social Class IIIM (*IIIM*) includes skilled manual occupations, Social Class IV (*IV*) includes partly skilled occupations, and Social Class V (*V*) includes unskilled occupations

where e_t^k is effort devoted to activity k. A range of activities can be performed within a certain set, i.e., $k \in \{1, \ldots, K_t\}$ at age $t = 1, \ldots, T$, and the effort the individual devotes to a certain activity depends not only on her capabilities but also on the rewards that she will receive for performing that activity. An important aspect of function (14.1) is that it allows for many different ways to achieve a given outcome, so that a shortfall in one dimension of child capabilities might be compensated by greater strength in another. For example, a low level of cognition can be compensated by greater motivation and perseverance, so as to allow the child to achieve a certain level of education or of earnings. In the next section, we provide some recent evidence on the importance of the different dimensions of child well-being for adult outcomes.

(b) The second component of the framework is a dynamic process for the formation of capabilities, which is governed by a multistage technology. The *technology of capability formation* (Cunha and Heckman 2007) captures essential features of human development. It expresses the stock of period $t + 1$ capabilities (θ_{t+1}) in terms of period t capabilities (θ_t), investments (I_t), environments (h_t), and parental traits $\left(\theta_t^P\right)$:

Equation 14.2. Capability Dynamics

$$\theta_{t+1} = f_t\left(\theta_t, I_t, h_t, \theta_t^P\right) \tag{14.2}$$

I_t can be interpreted very broadly to include investments by parents, schools, and interventions; the latter can refer to time spent with parents, teachers, interventions at a preschool center, or materials that stimulate the development of the capabilities. θ_0 is a vector of initial endowments determined at conception, and I_{-1} is *in utero* investment. The different dimensions of the well-being of the child display *self-productivity* (earlier capabilities beget later capabilities). For example, a healthy child, or a child who is better able to pay attention in class, learns more and produces a greater store of cognitive ability. The function is increasing in all arguments: $\theta_{t+1} \uparrow$ as $\theta_t \uparrow$. Equation 14.2 captures the notion that capabilities at one age enhance capabilities at later ages, and that the development of capabilities in subsequent periods depends on the set of capabilities already present, and on investments, both at home and at school. If investment effects are especially strong in one period, it is called a *sensitive* period: if $\frac{\partial f_t(\cdot)}{\partial I_t} > \frac{\partial f_{t'}(\cdot)}{\partial I_{t'}}$ for all $t' \neq t$, t is a sensitive period. Sensitive periods exist when the investment has a higher payoff in that period than in any other one (but the payoff in other periods is not necessarily zero); for example, learning a second language is easier before age 12. If investments are productive in only one period, that is called a *critical* period: if $\frac{\partial f_t(\cdot)}{\partial I_t} = 0$ for $t \neq t*$, then $t*$ is a critical period for that investment. In other words, a period is defined as being critical if an investment has no effect in any other period; for example, a child born with a cataract will remain blind if the cataract is not removed on time, making any future investment in the child's eyesight futile. A key determinant of productivity is the degree of complementarity – how much the capabilities affect the productivity of investments. A crucial feature of the technology that helps to explain many findings in the literature on skill formation is *complementarity of capabilities with investment*, i.e., investment is more productive in children with higher stocks of capabilities $\left(\frac{\partial^2 f_t\left(\theta_t, I_t, h_t, \theta_t^P\right)}{\partial \theta_t \partial I_t'} \geq 0\right)$.

Two types of complementarity can be distinguished in this framework. The first type is a form of *static complementarity* between period t capabilities and period t investments: the higher the stock of capability θ_t, the higher the productivity of investment. Complementarity can occur both within a certain dimension (smarter children are better learners) or across different dimensions (more motivated children are better learners). The second type is *dynamic complementarity*, i.e., complementarity between investment in life-cycle period $t+1$ and investment in period s, $s > t+1$. This dynamic complementarity arises because early investments make later investments more productive. In other words, a high initial investment will improve skills at later periods, which in turn increases the productivity of later investments, and this happens because θ_t and I_t are complements. This mechanism works both ways: complementarity also implies that later investments raise the value

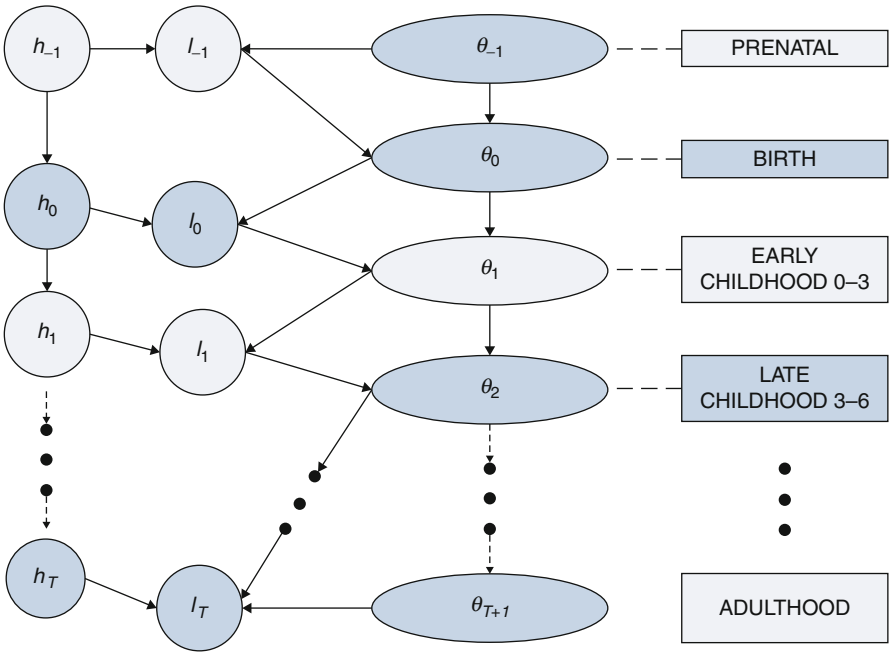

Fig. 14.4 A life-cycle framework for conceptualizing child well-being. θ_t: Capabilities at t; I_t: Investment at t; h_t: Environment at time t. $\theta_{t+1} = f_t(\theta_t, I_t, h_t)$

of earlier investments. In limiting special cases, later investments are crucial for earlier ones to be effective. Thus, early childhood interventions are not enough. To be effective, they have to be followed up with quality schooling and parenting.

Dynamic complementarity explains the evidence that early nurturing environments affect the ability of animals and humans to learn. It explains why investments in disadvantaged young children are so productive, because early investments enhance the productivity of later investments. It also explains why investments in low-ability adults often have such low returns, because the stock of θ_t is low.

Figure 14.4 demonstrates how adult outcomes are shaped by *sequences* of investments over the life cycle of the child. Hence, the importance of the early years depends on how easy it is to compensate for adverse early effects with later investment. Empirical relationships between early conditions and adult outcomes that ignore intervening investments and environments neglect potentially important determinants of adult outcomes and the possibilities of remediation and compensation. The evidence that we will review in the next sections shows that resilience and remediation are possible, but are more costly at later stages.

The dynamics of this model suggest some interesting logical possibilities that are borne out in the empirical evidence discussed in Sect. 14.5. Because of dynamic complementarity, investment in disadvantaged adolescents may be economically

inefficient. Unmotivated and low-ability children may not make good investments from a purely economic point of view. This evidence is consistent with the high economic returns to education found for high-ability adolescents (see Carneiro et al. 2003) and the low returns to remediation for low-ability adolescents (see Heckman et al. 1998). On humanitarian grounds, society may choose to invest in low-ability, unmotivated adolescents, but there is a sharp trade-off between equity and efficiency. This is the dark side of the economics of human development.

The bright side is that because of dynamic complementarity, investing early – laying the base for enhancing the productivity of adolescent investments – can have a substantial benefit. The returns to early investments can be higher for the children of disadvantaged parents compared to children of advantaged parents, even those born with cognitive and emotional deficits (see Cunha et al. 2010).

Estimating the Model. The model lends itself to estimation using latent variable factor analysis (Jöreskog 1977) – state space models (Hamilton 1994). The literature documents substantial measurement error in investments, capabilities, and family environments (see Cunha and Heckman 2008; Cunha et al. 2010; and the references cited therein); the aforementioned frameworks account for such error.

A commonly used linear specification for measurement vector M is the following:

Equation 14.3. Measurements on Investments, Environments, and Capabilities

$$M_t = \mu + \alpha Q_t + \upsilon_t \tag{14.3}$$

where M_t is a vector of measurements at age t, Q_t is a vector of factors (capturing θ_t, I_t, h_t, and θ_t^P), and υ_t is measurement error. The factors are the latent capabilities, investments, environments, and parental traits which are proxied by the measurements M_t.

This methodology allows analysts to address several issues in the child indicators field. First, it allows for multiple inputs in the production of child well-being, and for each input and each dimension of child well-being to be proxied by several indicators, which measure each dimension with error. Second, having specific equations for the measurements allows analysts to address issues of differential reliability and cross-culture comparability which typically plague the indicators constructed across countries (one solution recently adopted in the literature, especially in relation to subjective well-being and health measurement, is the use of vignettes to account for heterogeneity in response styles. However, the extent to which this approach helps in solving the problem is subject to debate. See Van Soest and Vonkova 2012. Hence, such an approach is useful not only in general for the creation of a taxonomy of child well-being, but in particular for the case of mental health and emotional well-being, which are dimensions difficult to measure, especially in a cross-country context (as noticed in UNICEF (2007) and Kieling et al. (2011)).

14.5 Evidence on the Determinants and Consequences of Child Well-Being

In this section we review recent evidence on the long-term effects of child well-being, its determinants, and dynamics, with a focus on studies based on the framework exposited in Sect. 14.4.

The Long-Term Effects of Child Well-Being. One of the first studies to apply this framework and go beyond the traditional focus on cognition, predominant in the economics literature, is Heckman, Stixrud, and Urzua (2006) [they build on the work of Bowles and Gintis (1976) and Bowles et al. (2001)]. The authors analyze adult outcomes as produced by a two-dimensional construct (cognition and personality traits). They investigate the effect of cognitive and personality traits on schooling and a variety of other outcomes, while also accounting for the reverse effect of schooling on the measured traits. They use the National Longitudinal Survey of Youth (NLSY79), a dataset containing measures on the components of the Armed Services Vocational Aptitude Battery (ASVAB), used to create the Armed Forces Qualifying Test (AFQT), a widely used measure of cognition. In addition, the NLSY79 has two measures of personality: the Rotter's locus-of-control scale, designed to capture the extent to which individuals believe that they have control over their lives through self-motivation (as opposed to the extent that the environment controls their lives), and the Rosenberg Self-Esteem Scale, which assesses the level of self-esteem. They show that the low-dimensional measures of child capabilities explain a large array of diverse outcomes, ranging from schooling to labor market outcomes (employment, work experience, occupational choice) and risky behaviors (smoking, drug use, incarceration, and teenage pregnancy). We summarize their estimates of the effects of capabilities on college graduation in Fig. 14.5, which shows that both cognitive and personality traits have strong effects on graduating from a 4-year college at all deciles of the capability distribution (the dotted lines are confidence intervals). In particular, the bottom-right panel shows that moving from the lowest decile to the highest decile in the dimension of personality (holding cognitive ability at its mean) increases the probability of graduating from college more than a similar percentile change in the cognitive trait distribution.

Carneiro et al. (2007) follow this approach and also recognize that assuming a unidimensional set of capabilities is an unsatisfactory view of child well-being. In their analysis of the British National Child Development Study (NCDS, the 1958 cohort), they show that low social skills, as measured by the Bristol Social Adjustment Guide, are large risk factors for smoking. They also emphasize that the importance of cognitive skills in affecting educational attainment and health outcomes depends on the level of social skills. Murasko (2007) adopts a life course approach and shows that child personality traits (greater internal *locus of control* and greater *self-esteem* at age 10) are predictive of health at age 30, beyond their effect of education. Jones et al. (2011) analyze the same dataset as used by Carneiro et al. (2007) and confirm that the social adjustment of the child is the strongest predictor of adult physical and mental illness. However, once they control for these traits, they find little effect of the quality of the school attended on adult health.

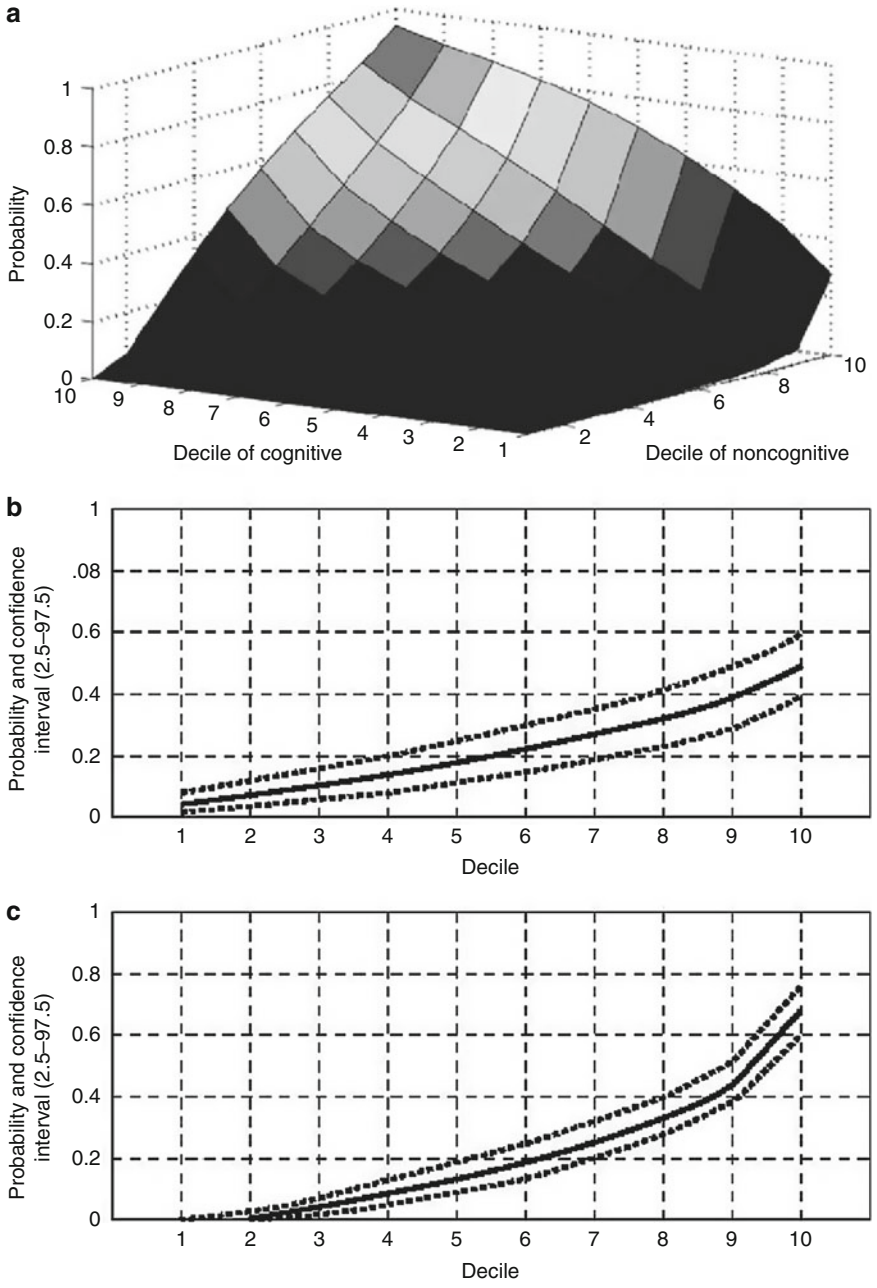

Fig. 14.5 Probability of being a 4-year college graduate or higher at age 30, males. (**a**) By decile of cognitive and noncognitive factors. (**b**) By decile of cognitive factor. (**c**) By decile of noncognitive factor. *Dotted lines* are 2.5–97.5% confidence intervals. (Source: Heckman, Stixrud, and Urzua (2006), who discuss the control variables and methodology)

More recent work has also included health as a dimension of child well-being, in addition to cognitive and behavioral components. Conti, Heckman, and Urzua (2010, 2011) and Conti and Heckman (2010) conceptualize child capabilities as being three-dimensional (cognition, self-regulation, and physical health) and use a variety of indicators for each of the dimensions (cognitive test scores, personality scales, and anthropometric indicators, respectively). They estimate a developmental model of how early-life endowments give rise to labor market and health disparities by education, which complement the traditional studies that have relied on quasi-experimental evaluations. The authors develop a general latent variable model that explicitly accounts for how the traits affect education and how these early-life endowments and education affect later outcomes. They separately identify selection effects from causal effects and provide guidance on the effects of educational interventions.

They analyze the British Cohort Study – a survey of all babies born after the 24th week of gestation from Sunday, April 5, to Saturday, April 11, 1970, in the United Kingdom. There have been seven follow-ups to track all members of this birth cohort: 1975, 1980, 1986, 1996, 2000, 2004, and 2008. Very rich information has been collected from several sources (parents, teachers, and doctors during a medical visit). They analyze information taken from the birth sweep (1970), from the second sweep (1980), and from the fifth follow-up sweep (2000). Information from the birth sweep includes the "family endowments," i.e., the parental resources that form the foundations for early learning experiences: the mother's age, education, father's social class, and parity at birth. This is supplemented with family information at age 10 that includes gross family income, whether the child has lived with both parents since birth, and the number of children in the family at age 10. Measurements in the second follow-up sweep include scores on standard cognitive tests such as math, English, language comprehension, and word definition; measurements of the child's personality taken from tests on locus of control, perseverance, and persistence were also included. These were supplemented by basic anthropometric measurements (height, head circumference, and the height of the child's parents) to proxy for child physical health. Their procedure accounts for measurement error, which they find to be substantial. The adult (age 30) outcomes they analyze include the final level of education achieved (whether the individual has stayed on beyond compulsory education), labor market outcomes (employment and wages), healthy behaviors (daily smoking and engaging in regular exercise), and health status (obesity, depression, and self-reported health).

We present their results on the effects of the early-life endowments on two particular dimensions of adult well-being: smoking and obesity. We report results on the effects of education in the next section. Figure 14.6 plots the average probability of being a daily smoker (top panel) or of being obese (bottom panel) along the distribution of each of the three dimensions of child well-being, while fixing the other two dimensions at their mean values (the adult outcomes and the child capabilities are simulated from the estimates of our model and from the data). The figure is constructed so that such probabilities are normalized to zero for an individual at the bottom of each dimension of the well-being distribution at age 10

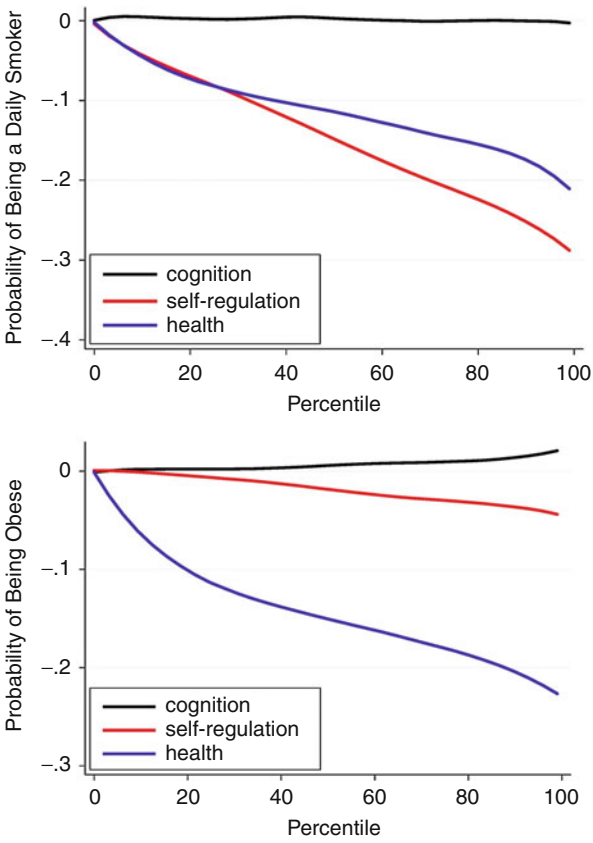

Fig. 14.6 Effect of age 10 capabilities on smoking (*top panel*) and obesity (*bottom panel*), males. [Source: Conti and Heckman (2010)]

(to set the scale and ease comparisons of the magnitude of the effects both across the different capabilities and across genders). The first striking result is that, while child cognition displays an important role in determining educational choices and labor market outcomes, it plays very little role in determining health and risky behaviors, especially for males. Conti and Heckman (2010) show that, when cognition is considered as the only dimension of child well-being (i.e., it is assumed to be unidimensional), it shows significant effects on all the adult outcomes considered. These effects vanish once they control for noncognitive traits. The second result is that both noncognitive dimensions (self-regulation and early physical health) are equally important determinants of adult outcomes for the nonlabor market outcomes. The top panel of Fig. 14.6 shows that an early intervention which improves the capacity of the child to self-regulate (holding his cognitive ability and health endowment constant at their mean levels) by moving him up from the 20th to the 80th percentile of the noncognitive distribution would reduce the probability of being a daily smoker at age 30 by more than ten percentage points. An effect of comparable magnitude is obtained for the physical health of the child. The only exception to this pattern is found for obesity, for which the early health dimension is the single most important determinant. As shown in

the bottom panel of Fig. 14.6, an early intervention that would improve the physical health of the child (by moving her from the bottom to the top percentile of the distribution) would bring about a reduction in the probability of being obese at age 30 by approximately 20 percentage points.

Further evidence on the importance of the noncognitive dimensions of child well-being is given in more recent work. Goodman et al. (2011) investigate the long-term effects of childhood psychological wellness and physical health in a cohort of children born in Britain in 1958, again using NCDS data. They find that childhood mental well-being, more than physical well- being, impacts negatively on a variety of adult outcomes, ranging from income and personal relationships to cognitive and emotional health. Interestingly, they find that adult education does not seem to be an important pathway. Daly (2011), instead, in his response to Goodman et al. (2011), shows that intelligence seems to account for a large portion of the relation between childhood emotional maladjustment and adult socioeconomic status; however, his analysis relies on the 1970, rather than on the 1958, cohort. Kaestner and Callison (2011) find that cognitive ability and self-esteem have a significant association with adult well-being, but locus of control has a lesser role. Conti and Hansman (2012), using also NCDS data, show that child personality contributes to the education-health gradient to an extent nearly as large as that of cognition.

The Dimensionality of Child Capabilities. The current indicators of child capabilities used in international comparisons construct indices by taking simple averages of the components constituting each dimension. This simple way of aggregating measurements is in widespread use in most of the literature on child well-being. While there is an evolving literature in psychometrics on methods to determine the number of dimensions in factor models, thus far, it has not been applied to understand the dimensionality of child well-being. A recent exception is the paper by Conti et al. (2012b), in which the authors develop a novel methodology for constructing indices over a large number of error-laden measures of related, but distinct, dimensions of human capability, without specifying the weights to be assigned to the indicators of the different dimensions, the assignment of the indicators to the dimensions, and the number of dimensions required to reduce the high-dimensional dataset.

They compare their approach to traditional approaches used in psychometrics to select the number of dimensions using scale-based taxonomies and methods based on factor-analytic techniques. Implementing this methodology on rich longitudinal data from Britain (the British Cohort Study, BCS70), they establish evidence on the structure of child capabilities (operationalized in terms of the dimensions of cognition, physical size, and mental health). They find that 13 dimensions underlie the 131 measurements in the BCS study. When comparing the aggregates obtained using their procedure with those obtained using simpler averages, they test and reject the assumption of equal weighting of the indicators used to construct each dimension as it is instead done in the construction of conventional indices. They find substantial evidence of correlations across the different capabilities.

The Production of Child Well-Being. We next provide evidence on the dynamic evolution of capabilities, on their interconnections, and on the existence of critical

and sensitive periods to develop each of them. This evidence gives us a more nuanced view of public policy and allows us to assess at which stages interventions to promote child well-being are most effective.

Among the very few papers in economics that have adopted a holistic perspective on child development is Shakotko et al. (1980). The authors postulate child well-being as a bidimensional construct (health and cognition) and analyze the dynamic relationship between these two components. They do not model investment (I_t) but consider the effect of parental environmental variables (θ_t^P). They find evidence of a continuing interaction between health and cognitive development over the life cycle, with feedback both from health to cognitive development and from cognitive development to health, the latter relationship being the strongest. They report substantial effects of parental environmental variables.

In a series of papers, Cunha and Heckman (2008, 2009) and Cunha, Heckman, and Schennach (2010) formulate and estimate models of parental investment, parental environmental influence, and human capital development which are faithful to the recent evidence from the biological sciences on the malleability of different abilities at different ages. They analyze two dimensions of child well-being (cognitive and noncognitive). Cunha and Heckman (2008) estimate a linear version of the technology (equation 14.2), where the evolution of the capabilities of the child is a function of their lagged values and of parental investments.

While linearity is a computationally convenient assumption, it implies that the inputs in the production of child capabilities are perfect substitutes, i.e., that over the feasible range, it is always possible to remediate for earlier disadvantage. Thus, linear models cannot provide reliable guidance for assessing the effectiveness of remediation policies. Their results show strong self-productivity effects for both capabilities and strong cross-productivity effects of noncognitive skills on cognitive skills (evidence that personality factors promote learning), but not vice versa. A key finding of this research is that parental investments affect cognitive skills more strongly at earlier rather than at later ages, while they affect the noncognitive dimension more in middle childhood.

Cunha, Heckman, and Schennach (2010) estimate a nonlinear version of the technology of capability formation. This innovation is important as it allows them to estimate key substitution parameters, necessary for the design of strategies for early vs. late interventions. They assume that childhood is made of two stages: stage I corresponds to birth through age 4 and stage II to ages 5–14. The major findings from their analysis can be summarized as follows: (1) skills become harder to budge with age; (2) it is more difficult to compensate for the effects of adverse environments on cognition at later than at earlier ages; and (3) the malleability of noncognitive skills remains unchanged over the childhood life cycle. The last point implies that if remediation for adolescents is to be effective, it should focus on addressing noncognitive skills (see Heckman, Humphries, and Kautz (2013) for evidence on this point).

In order to examine the implications of their estimates, they consider the problem of determining how to optimally allocate investments from a fixed budget in order to maximize schooling for a cohort of children. The profile of optimal early (left panel)

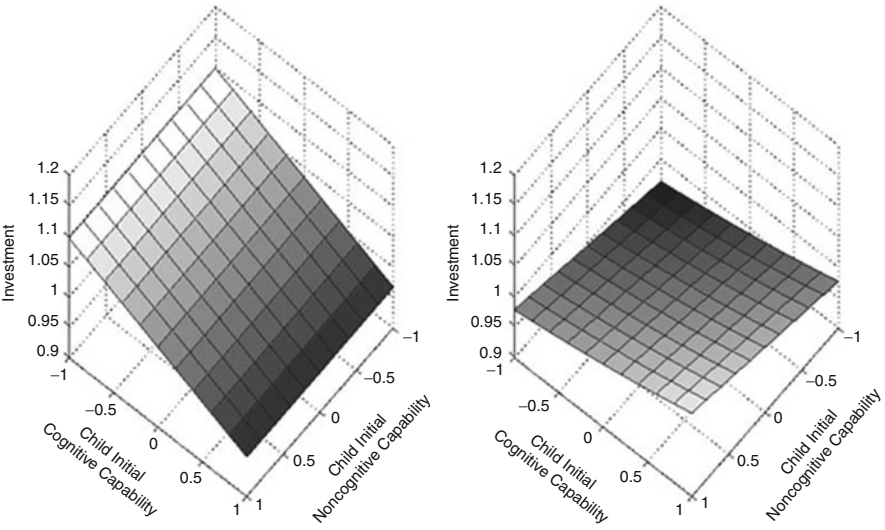

Fig. 14.7 Optimal early (*left*) and late (*right*) investments by child initial conditions of capabilities to maximize aggregate education. [Source: Cunha, Heckman, and Schennach (2010)]

and late (right panel) investment as a function of child endowments is plotted in Fig. 14.7. The important point to notice is that, for the children born in the most disadvantaged conditions (i.e., with low values of both cognitive and noncognitive capabilities), the optimal policy is to invest a lot in the early years (left panel), when there is also a substantial decline in the optimal investment by level of initial advantage (note lighter shades in the figure correspond to higher values of investment). On the other hand, the optimal investment level profiles in the second period (right panel) are much flatter and slightly favor the more advantaged children. It is socially optimal to invest more in the second period in advantaged than in disadvantaged children. The authors find a similar investment profile when considering optimal investments to reduce aggregate crime. Standard models in criminology assign no role to investments (see, e.g., Nagin and Tremblay 2001).

This important result is a manifestation of the dynamic complementarity which produces an equity-efficiency trade-off for adolescent but not for early investment. In the next section, we provide further evidence on the effectiveness of early vs. late intervention.

14.6 Policies to Promote Child Well-Being

While the field of the measurement of child well-being has moved away from simple income/poverty-based indices, to indicators centered on a more holistic view of the child, policy attention has mostly focused on improving the financial position of the families (e.g., with cash benefits and tax breaks, child care, parental leave).

However, increases in family resources do not necessarily translate into increased investment in children. It is quality parenting that promotes successful, flourishing lives of children. In this section, we provide recent evidence on the effectiveness of early and late interventions to compensate in part for the risks arising from disadvantaged environments.

Before doing so, we note that one important point underemphasized in the current literature is that the interventions implemented differ in terms of: the populations targeted, the objectives and philosophies of the programs, the measures taken, the measurement instruments used, the backgrounds of the children and their families, and the methods of evaluation. Programs differ in so many different ways that it is often difficult to isolate the specific components leading to the success of one and the failure of another. Additionally, the intervention studies need to be integrated with the studies of family influence, in order to understand how public investments affect the private investments of the parents. Finally, alternative interventions need to be assessed in comparable metrics – in terms of rate of return or cost-benefit analysis – in order to place the evaluation of specific policies aimed at compensating for disadvantage on a common footing. There is the need to move beyond collections of "treatment effects," which are hard to interpret or to use as the basis for policy when a variety of competing proposals are on the table. Cost-effectiveness matters for policy, since governments have limited resources to allocate between competing programs. However, few evaluations include rigorous cost-benefit analyses, which are primarily limited to the major early childhood interventions. Moreover, cost-benefit ratios might be underestimated, because many outcomes cannot be easily monetized (e.g., improvements in health and mental health), and siblings (or other family members) can benefit from spillovers. Most studies only consider some outcome domains, and labor market information is limited to early adulthood. Extrapolating benefits based on early effects on test scores, educational attainment, or earnings is a dangerous business. Long-run follow-ups are essential when assessing cost-effectiveness, because many effects of interventions fade out over time. Finally, interventions are also likely to yield social returns. For example, lower crime rates and lower dependence ratios are both beneficial for the individual and the society. In order to design, implement, and evaluate effective policies to promote child well-being, it is important to go beyond meta-analyses and understand the *mechanisms* that produce the treatment effects and can be compared across interventions. This is true not only for policies specifically targeted at promoting child well-being but also for comparison of a variety of policies that compete with childhood policies for funding.

14.6.1 Early Interventions

The most reliable evidence on the effectiveness of early interventions comes from experiments that substantially enrich the early environments of children born in disadvantaged families. Two of these investigations, the Perry Preschool Project and the Abecedarian Project, are particularly revealing because they use a random

assignment design and continue to follow the children into their adult years. These studies demonstrate substantial positive effects of early environmental enrichment on a range of cognitive skills and behavioral traits, school achievement, job performance, and social behaviors – effects that persist long after the interventions have ended. Other studies – such as the Nurse-Family Partnership, which visits pregnant girls and teaches them prenatal health practices and parenting – support these conclusions.

The Abecedarian Project. The ABC studied 111 disadvantaged children born between 1972 and 1977 whose families scored high on a risk index. The mean age at entry was 8.8 weeks. The program was a year-round, full-day intervention that continued through age eight. It was more intensive than the Perry intervention. It consisted of a two-stage treatment: a preschool intervention focusing on early childhood education and a subsequent school-age intervention focusing on the initial schooling age period. It used a systematic curriculum specially developed by Sparling and Lewis (1979, 1984) that consisted of a series of "educational games," which emphasized language, emotional development, and cognitive skills. The children were followed through their mid-30s; the mid-30s data collection (a biomedical sweep) was just recently completed. The initial infant-to-teacher ratio was 3:1, though it grew to 6:1 as the kids progressed through the program. Infants in the control group received an iron-fortified formula for 15 months and diapers as needed to create an incentive for participation (Campbell et al. 2001, 2002). Many of the children in the control group were enrolled in preschool and/or kindergarten. During the first three primary school years, a home-school teacher would meet with the parents of the children who were in the treatment group and guide them in providing supplemental educational activities at home. The teacher provided an individually tailored curriculum for each child. This home-school teacher also served as a liaison between the ordinary teachers and the family, and she would interact with the parents and the teachers about every 2 weeks. She would also help the parents find employment, navigate the bureaucracy of social services agencies, and transport children to appointments, all of which could improve parents' ability to raise their children (Campbell and Ramey 1994).

The Perry Preschool Study. Perry was an intensive preschool curriculum administered to 58 low-income black children with initial IQs below 85 at age 3, in Ypsilanti, Michigan, between 1962 and 1967 (the control group includes 65 children). It used the High/Scope curriculum, an highly interactive approach that promotes student involvement. Activities took place within a structured daily routine intended to help children to "develop a sense of responsibility and to enjoy opportunities for independence" (Schweinhart et al. 1993). The treatment consisted of a daily 2.5-hour classroom session on weekday mornings and a weekly 90-min home visit by the teacher on weekday afternoons, to promote parent-child interactions. The curriculum was geared toward the children's age and capabilities, emphasizing child-initiated activities that focused on fostering noncognitive traits. Staff encouraged children to engage in play activities that had children plan, do, and review tasks each day: students planned a task, executed it, and then reviewed it with teachers and fellow students. The reviews were collective and taught the

children important social skills. The length of each preschool year was 30 weeks, and the program ended after 2 years of enrollment. The control and treatment groups have been followed through age 40.

Both Perry and Abecedarian have showed consistent patterns of successful outcomes for treatment group members compared with control group members. Among Perry participants, an initial increase in IQ disappeared gradually over the 4 years following the intervention. Such IQ fade-outs have been observed in other studies. But the main effects of the Perry remained, and they involve noncognitive traits (Heckman et al. 2012). Even though they were no brighter than the controls as measured by IQ tests, the Perry adolescent treatment group members faired better than the control group on achievement tests at age fourteen because they were more engaged in school. Positive effects were also documented for a wide range of social behaviors. At the oldest ages studied (40 years for Perry; 30 for Abecedarian), treated individuals scored higher on achievement tests, attained higher levels of education, required less special education, earned higher wages, were more likely to own a home, and were less likely to go on welfare or be incarcerated than controls. Heckman et al. (2012) show that the Perry Preschool Program worked primarily through socioemotional channels; even if the program did not have a lasting effect on IQ scores, the personalities of participants improved. Participants of both genders improved their externalizing behavior. They also show that different dimensions of the well-being of the child affect different outcomes. Cognition primarily affects achievement tests and also certain labor market outcomes. Externalizing behavior affects crime outcomes, labor market outcomes, and health behaviors. Academic motivation boosts educational outcomes and reduces long-term unemployment. The importance of each of these three dimensions of child well-being in explaining the treatment effects from the intervention is reported in Fig. 14.8. Each bar represents the total treatment effect of the intervention, normalized to 100%, on the outcome listed on the left side; the total (non-normalized) treatment effect is reported in parentheses. For example, we see that the intervention increased the duration of marriage by almost 40 months: women in the control group have experienced, on average, 48 months of marriage by the time they reach age 40, whereas those in the treated group have been married on average 88 months. Each bar is further decomposed into various parts, which represent the percentage of the treatment effect on that particular outcome attributable to that particular component of child well-being: cognition, externalizing behavior, and academic motivation; the share of the treatment effect which is left unexplained is also shown (the numbers reported above each component are one-sided p-values which show whether the contribution of that particular component to the treatment effect is statistically significant). It is evident that the effect of the intervention on life outcomes operates primarily through the program's enhancement of externalizing behavior: components attributable to changes in this factor are generally statistically significant and explain up to 60% of the treatment effect on crime. The crime effects are particularly important, since they are the main components of the benefits from Perry (Heckman, Pinto, and Savelyev, 2012). Moreover, experimentally induced increases in academic motivation and cognition also play

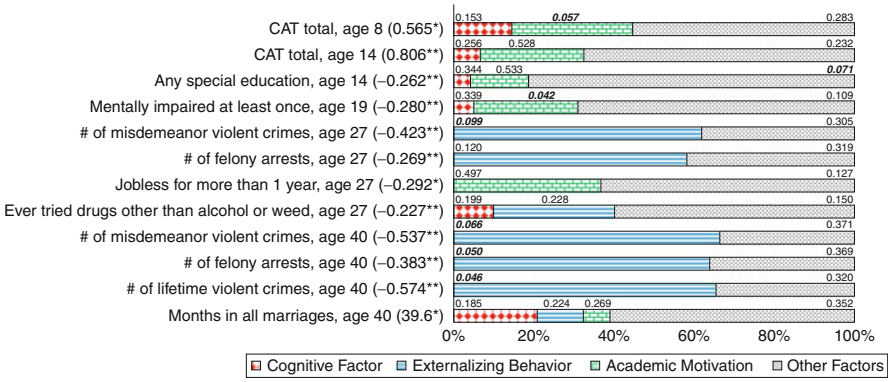

Fig. 14.8 Decomposition of treatment effects on outcomes, females [Source: Heckman, Pinto, and Savelyev (2012)]. Note: The total treatment effects are shown in parentheses. Each *bar* represents the total treatment effect normalized to 100%. One-sided *p*-values are shown above each component of the decomposition. Asterisks denote statistical significance: *10 percent level; **5 percent level; ***1 percent level

a non-negligible role in explaining the effects of the program: for example, the latter component explains 20% of the effect of the treatment on the duration of marriage. The estimated rate of return (the annual return per dollar of cost) to the Perry project is 7–10% (higher than the 5.8% returns on stock market equity received from the end of World War II through 2008; see Heckman et al. (2010b)). This estimate is conservative because it ignores economic returns to health and mental health, which are currently being incorporated. Conti and Heckman (2013) report significant treatment effects on health an healthy behaviors for both the Abecedarian and the Perry interventions.

The Nurse-Family Partnership. The Nurse-Family Partnership targeted unmarried pregnant girls of adolescent age with low income and no history of live births. The program recruited women with these characteristics because it aimed to address problems (e.g., poor birth outcomes, child abuse and neglect, and diminished economic self-sufficiency of parents) concentrated in these populations. The program has been implemented in a series of randomized trials conducted in Elmira, New York ($n = 400$), Memphis, Tennessee ($n = 1{,}135$), and Denver, Colorado ($n = 735$). In each of these three sites, women were randomized to receive either home visitation services during the pregnancy and the first 2 years of the lives of their children, or comparison services. The program has been shown to improve the well-being of the child (fewer injuries) and of the mother (fewer subsequent pregnancies, greater work force participation, and reduced use of public assistance and of food stamps); see Olds (2002) for a summary of the main results from the three sites. Additionally, in the Denver trial, the program was administered either by nurses or paraprofessionals; it has been shown that, for most outcomes on which either visitor produced significant effects, the paraprofessionals typically had effects that were about half the size of those produced by the nurses (Olds et al. 2002).

Among other early interventions, the Tools of the Mind curriculum is similar to High/Scope. It is inspired by the work of Vygotsky, who emphasized the importance of the learner to interact with the environment and to explore it independently with her own senses. Vygotsky also promoted assisted discovery (or scaffolding): children are guided in their learning by the teachers, and are also aided by their peers, as they work in groups of mixed abilities. It was developed by the educational psychologists Elena Bodrova and Deborah Leong (2007), and it targets the development of core executive functions (EF) in preschoolers, such as inhibitory control, working memory, and cognitive flexibility. In Tools, techniques for supporting, training, and challenging EFs are intertwined in almost all classroom activities throughout the day, consistently with the Vygotskian idea that EFs develop as children are engaged in specific interpersonal interactions. The most convincing evidence on the effectiveness of the Tools of the Mind curriculum comes from a randomized evaluation which was carried out in an urban school district in the Northeast, after the opening of a publicly funded preschool program for poor children. From the list of parents who signed up, children were randomly assigned either to the Tools curriculum or to a version of the balanced literacy curriculum, which had been developed by the school district (dBL). This was based on the idea that literacy should be taught to young children in a balanced way, i.e., through a combination of different activities. In practice, it covered the same academic content as the Tools curriculum but without any activity intentionally designed to promote EF development (children were not expected to regulate each other or themselves in the classroom). Diamond et al. (2007) compare the outcomes of 147 preschoolers randomly assigned and show that children who received the Tools curriculum showed improved performance in EF measures, as compared to the children who received the dBL curriculum. Contrary to these results, a recent large-scale study (Farran and Wilson 2012) does not find any significant effect of the program on literacy, language, mathematics achievement, or self-regulation, after one year of implementation. However, Diamond et al. (2007) provide suggestive evidence that it takes two years before positive effects can be identified, since the teachers need to adjust their practices to the new curriculum.

Other preschool interventions have shown evidence of significant effects. However, a proper comparison among them requires an understanding of the different components of the various curricula, in order to identify the mechanisms through which the various programs operate and produce improved outcomes. Recent reviews of early childhood interventions (Nores and Barnett 2009; Baker-Henningham and Lopez Boo 2010) conclude that mixed interventions (i.e., those involving an educational, care, and stimulation component) of greater intensity and of longer duration are the most effective. Additionally, they conclude that interventions should target younger and more disadvantaged children and actively seek the involvement of the families and of the caregivers. However, they recognize that more research is needed to determine the optimal age and mode of delivery and that careful cost-benefit analyses should be incorporated in the evaluations of the interventions.

Finally, the evidence on late childhood interventions, instead, reveals that they have been less successful in promoting child well-being [see the evidence in Cunha et al. (2006) and Chapter 10 in Heckman, Humphries and Kautz (2013)]. Durlak et al. (2011) present a meta-study of 213 school-based social and emotional learning programs. This shows that, while some programs have been successful, many of the evaluations they include suffer from methodological problems. Only 47% of the programs studied are randomized, and only 15% contain follow-ups that go beyond 6 months. When long-term follow-ups are available, these programs usually show no persistent gains. A typical example is the Quantum Opportunity Project (QOP), which provided both counseling services by means of a qualified mentor and financial incentives to participants for a duration of four years. While showing positive short-term effects on high school graduation, most of its positive effects faded out by the 10-year follow-up (Rodriguez-Planas 2012a).

Education. There is a long ongoing debate on the usefulness of education to remediate preexisting disparities and to promote well-being (see Lochner (2011) for a recent survey of the evidence). The economic literature has addressed this question mainly by using quasi-experimental designs. In a series of papers, Conti et al. (2010, 2011) and Conti and Heckman (2010) break new ground in the education-health debate (as noted in Mazumder (2012)) by using a developmental model, which recognizes that education is itself determined by early-life traits – dimensions of child capabilities – and is an outcome of child well-being itself (note that educational attainment is one of the indicators included in the UNICEF and OECD taxonomies reviewed in the introductory section). The authors first address the question as to whether education has a causal impact on adult outcomes or if it is just a proxy for dimensions of child capabilities, which affect both the educational choice and the outcomes themselves. The extent to which education impacts well-being is shown in Fig. 14.9, where the length of each bar shows the mean differences at age 30 in a number of outcomes (health, health behaviors, and labor market outcomes) between individuals who have dropped out at the minimum compulsory school leaving age (16 years in Britain at the time we consider) and those who have stayed on beyond age 16 to achieve a post-compulsory educational qualification. These raw differentials are then decomposed into a component attributable to early-life determinants and another caused by schooling itself – what economists call the "treatment effect" of education. This decomposition exercise shows that, while education has huge effects across many outcomes (the dark portion of the bar represents the share of the disparity which can be attributed to the causal effect of education), early-life dimensions of child capabilities also play a key role: first, they promote attendance in schooling, and second, they have an independent effect in their own right on several adult outcomes. Importantly, education has a stronger effect on health behaviors than on health outcomes per se. This makes a strong case for prevention by investing in child well-being. The second question that the authors address is whether the success of later interventions depends on the quality of earlier ones and on the nature of the capability created. An example on how the effect of education on one dimension of adult

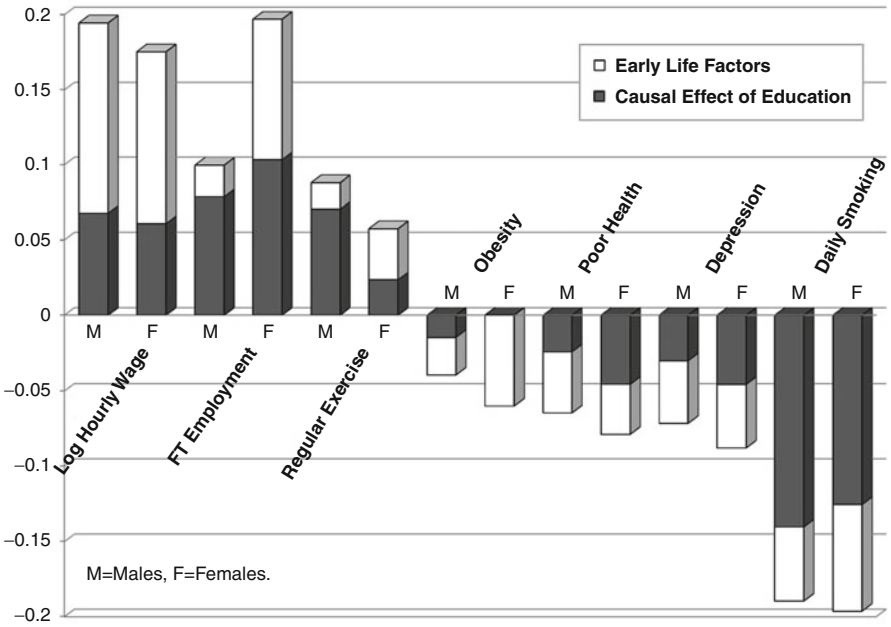

Fig. 14.9 Educational disparities in labor market and health outcomes in the BCS70. [Source: Conti, Heckman, and Urzua (2010)]

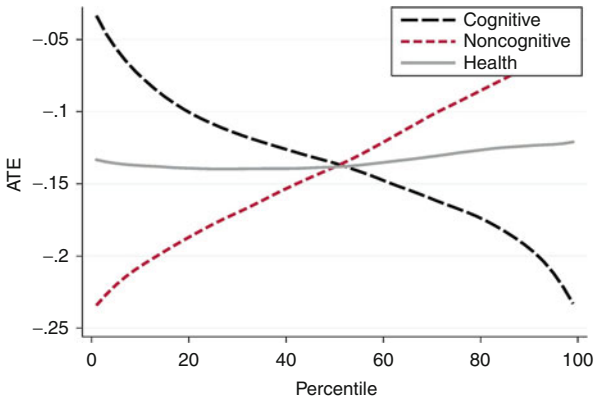

Fig. 14.10 Effect of education on smoking by percentiles of the distribution of child well-being [Source: Conti and Heckman (2010)]

well-being – the unhealthy behavior of smoking – varies with different dimensions of child capabilities is presented in Fig. 14.10. Here, it is shown that the beneficial effect of education, in terms of the percentage point reduction in the probability of being a daily smoker by age 30, is much bigger for adults who were at the top of the cognitive ability distribution, but at the bottom of the noncognitive ability distribution at age 10 (When estimating the effect of post-compulsory education on the probability of being a daily smoker along the distribution of each capability,

the other two capabilities are fixed at their mean values). In other words, education has a reinforcing effect for cognitive capabilities and a compensatory effect for psychological dimensions of child well-being. This evidence on differential effects of education by level of cognition in childhood is consistent with the interpretation that the information content on the dangers of smoking provided by post-compulsory education needs to be combined with the capacity to process that information in order for it to be effective. On the other hand, the evidence of a greater effect of education for adults who had self-regulation problems in childhood is consistent with evidence of the malleability of the prefrontal cortex – and so of skills related to discipline and self-control – into the adolescent years. Hence, while it is more effective to start young, there are still effective strategies for addressing the problems of disadvantaged adolescents.

A consolidated body of evidence suggests that cognitive skills are established early in life and that boosting raw IQ and problem-solving ability in the teenage years is much harder than doing so when children are young. But social and personality skills are malleable into the early twenties, although early formation of these traits is still the best policy because they boost learning. The timing of specific policies and interventions should be designed on the basis of the malleability of the capability they target. However, as currently implemented, public job training programs, adult literacy services, prisoner rehabilitation programs, and education programs for disadvantaged adults produce low economic returns (Cunha et al. 2006). Moreover, studies in which later interventions showed some benefits also found that the performance of disadvantaged children was still behind the performance of children who also experienced interventions in the preschool years. In sum, if the base is stronger, the return to later investment is greater.

The essence of the argument of investing in child well-being can be summarized in Fig. 14.11, which shows the return to a unit dollar invested by stage of the life cycle. This graph captures the returns to a hypothetical investor who is deciding where to place his/her money in the life of a newborn. From a purely economic standpoint, the highest return to a unit dollar invested is at the beginning of the life cycle since it builds the base that makes later returns possible. One important point to clarify is that the argument to invest in child well-being does not say that there is no return to schooling or later investment. Indeed, for those with a good base, the economic benefits are substantial (see Carneiro et al. 2003). The high early returns arise in part because they promote substantial benefits for later-life investment. The logic suggested by this figure should be to promote a policy of prevention, rather than remediation, since it is much more cost-effective to help disadvantaged children earlier on than to remediate later on. Yet despite the evidence, society underinvests in disadvantaged young children. Less-educated women tend to be single parents. They work in low-wage jobs and do not invest much in their children. More educated women, even if single mothers, are not only working more but also investing more in their children – effectively increasing the gap between the advantaged and the disadvantaged (McLanahan 2004). As a result, inequality is being perpetuated – and even increased – across generations. The solution to this problem is to invest in the promotion of child capabilities beginning at conception.

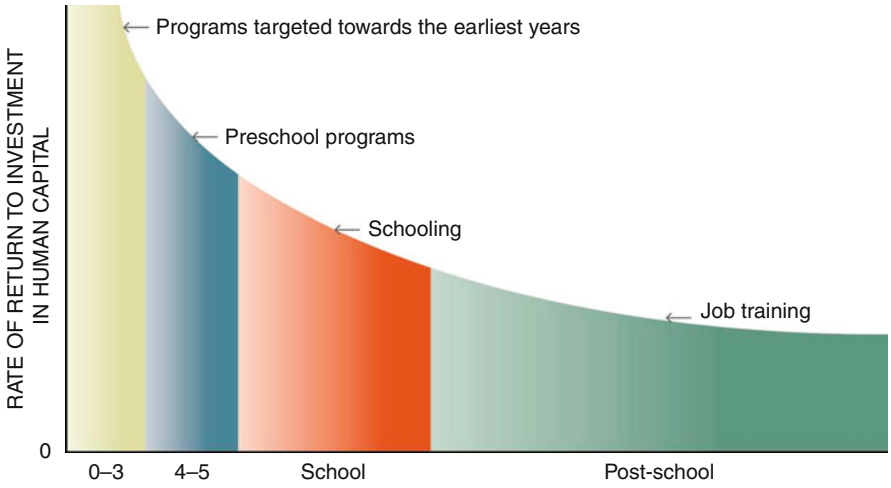

Fig. 14.11 Returns to a unit dollar invested by stage of the life cycle

At the same time, we cannot abandon the children who have had no access to this foundational opportunity, or the adults, who did not have such opportunities as children. However, the key to successful remediation is to invest in carefully designed programs which address those capabilities amenable to change.

Evidence from Neuroscience and Genetics. From the current state of knowledge, it is clear that adverse conditions in early life induce changes in brain structure and functions and that these environmental stressors can affect epigenetic programming of long-term changes in neurodevelopment and behavior (Murgatroyd and Spengler 2011). Two key aspects have to be considered: first, the temporal nature of brain development, and second, the temporal and gene-specific manner of epigenetic programming. With regard to the former, different brain regions pass through critical windows of sensitivity in different periods, so that environmental exposures at different ages will affect different areas of the brain. For example, environmental exposures in the late prenatal and early postnatal period are associated with changes in the hippocampus (McCrory et al. 2010), while cortical development continues into adolescence (Wang and Gao 2009). Additionally, while the reversibility of structural and functional changes in the brain, following alterations in social and emotional conditions, has not been systematically investigated, recent research in humans is beginning to document the effects of specific interventions to reduce stress and promote well-being on brain structure and function (see Davidson and McEwen (2012) for a recent review). With regard to the second aspect, the way epigenetic marks translate from a transient state to lasting cellular memory is still a black box; the best available evidence comes from animal studies and suggests that early adversity gets under the skin and establishes stable marks very early (e.g., Murgatroyd et al. 2010). However, the question of whether critical

windows for psychotherapeutic and pharmacological interventions (the so-called epigenetic drugs) might exist before the establishment of stable epigenetic marks is still open. While environmental enrichment in puberty has shown positive effects both in animals (Imanaka et al. 2008) and in humans (Fisher et al. 2007), the optimal timing and duration and the most effective components of such interventions might be quite specific and dependent upon the nature of early-life adversity. Above all, the quantitative importance of these epigenetic effects and the nature itself of these biological changes – whether they are on a causal pathway between early-life conditions and late outcomes – needs to be rigorously established. What is known supports the framework of Sect. 14.4 and the evidence summarized in Sect. 14.5. Knowledge is accumulating rapidly, and designing and implementing biologically based interventions is the key to promoting the well-being of the future generation, while not abandoning the current one.

14.7 Future Directions

Incorporating Lessons from Biology. In sum, while much remains to be learned, there are important hints in the literature. The literature is actively addressing the following questions. How important are investments and environments in the early years as compared to later-stage investments and environments? How should investments be staged over the life cycle to promote human flourishing? How effective are later-life compensations for early-life effects of adversity? In order to make progress, biological and socioeconomic mechanisms need to be thoroughly investigated.

First, the literature on the neurobiology of resilience and reversibility of risk shows mounting evidence that the adverse effects of early-life conditions might be coped with (Feder et al. 2009) or are at least partially reversible; for example, there is increasing evidence of plasticity in key brain areas (Davidson and McEwen 2012); of restoration in telomere function by diet, exercise, and stress reduction (Puterman and Epel 2012); and even of reversing the prenatal adaptations from fetal malnutrition following dietary changes (Burdge et al. 2009). The key aspects seem to be the windows of plasticity for specific organs. Experience gets embodied in the biology of the organism. Recent evidence on gene-environment interactions shows us how experience gets under – and stays under – the skin and how early childhood environments, together with genetic variation, alter epigenetic regulation and change developmental trajectories by altering human biological processes (Hertzman and Boyce 2010). Recent evidence from nonhuman primates shows that early-life experiences can trigger epigenetic changes, which manifest very early, are not the results of cumulative exposures (Cole et al. 2012), and can have long-term consequences, without being reversed by a normal social environment later in life (Conti et al. 2012).

Second, the existence of gender differences in the effects of interventions (Bandy 2012 and Bell et al. 2012) needs to be more thoroughly investigated, to disentangle biological and socioeconomic channels. An example of the complex

Table 14.1 Childhood biological and socioeconomic correlates of well-being at age 15

	Percentage of fat at age 15		IQ at 15	
	Males	Females	Males	Females
Log of interleukin-6 (IL-6) at age 10	–0.372	0.631***	0.239	0.375
	(0.236)	(0.236)	(0.425)	(0.426)
Log of C-reactive protein (CRP) at age 10	1.882***	1.883***	–0.0634	–0.436
	(0.183)	(0.174)	(0.330)	(0.314)
Low birth weight (<2,500 g)	–0.917	0.821	–3.043**	–0.541
	(0.828)	(0.869)	(1.470)	(1.595)
Family income 200–300 £ per week	0.761	–0.960	-2.621	1.585
	(0.936)	(0.837)	(1.687)	(1.502)
Family income 300–400 £ per week	0.144	–0.548	-0.501	2.468*
	(0.897)	(0.802)	(1.624)	(1.438)
Family income more than 400 £ per week	0.240	–1.213	2.054	3.774***
	(0.843)	(0.750)	(1.536)	(1.342)
Mother has O-level education	0.634	–1.179**	4.485***	3.937***
	(0.559)	(0.524)	(0.998)	(0.949)
Mother has A-level education	0.0616	–1.680***	9.456***	7.955***
	(0.584)	(0.554)	(1.040)	(1.007)
Mother has degree-level education	–0.843	–2.208***	14.33***	14.10***
	(0.649)	(0.620)	(1.162)	(1.128)
Observations	1,498	1,537	1,400	1,437
R-squared	0.086	0.128	0.175	0.154

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Other controls not shown in the table are race, binary indicators for missing family income and maternal education, age, and medication at blood collection. Family income is measured at age 8; mother's education is measured at gestation. The reference category for family income is less than 200 £ per week; the reference category for mother's education is less than O-level. Source: Own calculations based on the Avon Longitudinal Study of Parents and Children (ALSPAC)

interconnections between biological and socioeconomic factors is suggested by the analysis reported in Table 14.1. In this table, we report a multiple regression analysis of two measures of late childhood capabilities: the IQ score and the percentage of fat, both measured at age 15. Regressors are family background factors (family income and mother's education) and child health conditions (both standard measures like birth weight and biomarkers for inflammation [C-reactive protein (CRP) and the cytokine interleukin-6 (IL-6); see Slopen et al. (2012)]. We make several observations. First, mother's education shows a stronger association with child well-being than family income. The strength of the association increases with the level of maternal education. Second, being born in poor health conditions only affects cognitive outcomes and with an effect which is gender-specific. Being born with a low birth weight is associated with, on average, an IQ score of three points lower at age 15 for males. However, there is no such cognitive penalty for females. No significant association is uncovered between low birth weight and the proportion of fat at age 15. Third, the two biomarkers of child health which are available in the data – the C-reactive protein and interleukin-6 (both proxies for

inflammation) – show, instead, a strong and significant association with the percentage of fat mass at 15 years. In sum, the main message of this table is that, while family background measures and traditional proxies for health are significant determinants of cognitive measures routinely used in economics, the analysis of more refined measures of child well-being – such as the percentage of fat – requires incorporation of more biological proxies, which capture the extent to which the early-life environment has permeated within the body. In this respect, both IL-6 and CRP are significant predictors of the physical well-being of the child, with an effect that also varies by gender and which is poorly captured by other measures.

Finally, even bigger challenges for future research are to find out which approaches best serve which subpopulations, which skills these programs improve, and ideally, which aspects of the program are responsible for these changes in skills. Hence, our ability to design effective policies will increase as evidence from the biological sciences on windows of plasticity for specific dimensions sharpens. Our ability to evaluate policies will also improve as the availability of biomarkers in the data accessible to researchers increases, better enabling them to measure the functioning of specific parts of the brain and of the body, all of which contribute to different aspects of human well-being.

Open Questions for Future Research and Policy. Several practical questions also need to be addressed.

1. *Who should be targeted?* The returns to early childhood programs are highest for disadvantaged children who do not receive substantial amounts of parental investment in the early years. The proper measure of disadvantage is not necessarily family poverty or parental education: the available evidence suggests that the quality of parenting is the important scarce resource. So we need better measures of risky family environments in order to achieve more accurate targeting.
2. *With what programs?* Programs that target the early years seem to have the greatest promise. The Abecedarian and Perry programs show high returns. Equally suggestive is the analysis of the Nurse-Family Partnership. Programs with home visits affect the lives of the parents and create a permanent change in the home environment that supports the child after center-based interventions end. Programs that build character and motivation, and do not focus exclusively on cognition, appear to be the most effective, especially in the adolescent years.
3. *Who should provide the programs?* In designing any program that aims to improve the well-being of children, it is important to respect the sanctity of early family life and cultural diversity. The goal of early childhood programs is to create a base of productive skills and traits for disadvantaged children from all social, ethnic, and religious groups. Engaging the private sector, including privately constituted social groups and philanthropists, augments public resources, creates community support, and ensures that diverse points of view are represented.
4. *Who should pay for them?* One could make the programs universal to avoid stigmatization. Universal programs would be much more expensive and create the possibility of deadweight losses whereby public programs displace private

investments by families. One solution to these problems is to make the programs universal but to offer a sliding fee schedule based on family income.

5. *Will the programs achieve high levels of compliance?* It is important to recognize potential problems with program compliance. Many successful programs change the values and motivations of the child. Some of these changes may run counter to the values of certain parents. There may be serious tension between the needs of the child and the acceptance of interventions by the parents. Developing culturally diverse programs will help avoid such tension. One cannot assume that there will be no conflict between the values of society as it seeks to develop the potential of the child and the values of the family, although the extent of such conflict is not yet known.

14.8 Conclusions

This chapter presents an economic framework for conceptualizing child well-being in a developmental perspective. It reviews recent evidence which shows that investing in the capabilities of the children today is the most cost-effective policy to promote the capabilities of the adults tomorrow. This argument makes sense both on equity and efficiency grounds. Despite the logic and the evidence, most policies still overlook the efficacy of early interventions, leading to an underinvestment in the skills of very disadvantaged children.

The evidence presented in this chapter makes the case that rethinking the current American policy by investing more in the early years is an efficient and effective policy, both for the individual and the communities (Conti and Heckman 2012). The evidence from the economics of child well-being calls for a move from a policy of redistribution to one of pre-distribution of resources.

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