The Center for State Child Welfare Data

Human Capital, Child Well-being, and Child Protection

Working Paper (for discussion)

Fred Wulczyn, Arno Parolini, and Scott Huhr

December 2018



1313 E. 60th Street Chicago, IL 60637 (773) 256.5100 **fcda.chapinhall.org** © 2018 The Center for State Child Welfare Data

Human Capital, Child Well-being, and Child Protection

(Working Paper)

Fred Wulczyn¹ Arno Parolini² Scott Huhr¹

¹Center for State Child Welfare Data, Chapin Hall, University of Chicago ²Department of Social Work, Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne The authors contributed equally to the paper.

1 Introduction

In this paper we propose a framework that would add human capital and human capital formation to the list of outcomes child welfare agencies think about when their attention turns to child well-being. As a focal issue in policy and practice, child well-being has been an explicit part of the conversation in the United States since roughly 1997, following passage of the Adoption and Safe Families Act. In the ensuing years, more and more regulatory language has been devoted to the well-being of children interacting with the child welfare system. With that said, relatively little attention has been paid to the idea of well-being beyond the negative consequences of maltreatment on the developing child and the services needed to mitigate those experiences. Insofar as maltreatment has broad effects on the wellbeing of children, young people clearly need to be protected from adverse childhood experiences and supported in their efforts to manage the consequences of the adversity they do experience. However, protecting children from adversity is but one side of a two-sided developmental coin. Children must be both free from adversity and free to develop. Freedom from adversity speaks to the impediments that stand in the way of development; freedom to contemplates a developmental, forward looking process more explicitly. Children are children but not for long when a life course perspective is applied. Human capital and human capital formation, we argue, offer a conceptual language for bringing greater focus to well-being as a holistic developmental construct. In short, children should be free from adverse experiences that interfere with their freedom to develop the human capital needed to manage life course transitions successfully, from the very earliest days onward. This is particularly important considering that the conditions faced during childhood can have substantial and persistent effects on a person's life throughout adulthood (Almond & Currie, 2010; Almond, Currie, & Duque, 2017).

The paper is organized into three sections. In the first, we define human capital and the conceptual advantages human capital offers over the more general term well-being. In the second, we offer a conceptual model of human capital formation along with a mathematical framework for using human capital formation as the foundation for studies that integrate child protection and human capital. Human capital has been well studied in economics, with important advances in recent years, but its value as an organizing heuristic in the narrower field of child protection has yet to be argued. Our aim, then, is to provide guidance that shows an example of how a human capital framework might be used in empirical studies in a child protection context. We close with a brief discussion of the policy and practice implications invoked by considering both sides of the developmental coin.

2 What Is Human Capital?

Although human capital is most often associated with labor markets and whether adults have the *skills* needed to participate in gainful work (Becker, 1964), we take a broad view of human capital (Attanasio, 2015; Deming, 2017). Simply, we see human capital as encompassing a set of *skills* that affect participation by individuals in three spheres of contemporary life: the skills needed to form relationships centered around family, the skills needed to participate in community life, and the skills needed to participate in the world of work. The underlying skills are *diverse* and *interdependent*. They include cognitive skills as well as relational skills and social emotional skills, which are also referred to as

non-cognitive skills (Attanasio, 2015; Bowles, Gintis, & Osborne, 2001; Heckman & Kautz, 2012). These skills may be inherited or learned, although the importance of learned skills is more widely recognized today than in former times when the focus was on measures of cognitive ability (Farrington et al., 2012). As but one example of how components of human capital are interrelated, research suggests that social-emotional competencies and language acquisition are intertwined (Bierman, Domitrovich, Nix, & Gest, 2008; Elias, Zins, & Graczyk, 2003; Fantuzzo, Bulotsky, McDermott, & Mosca, 2003; Spratt et al., 2012).

Although the specific skills bundled together as human capital are important, the idea that human capital changes over time as a function of development is perhaps the more important insight as it places human capital formation within a life course context (Heckman & Conti, 2012). First, human capital formation begins early in life as the "rudimentary but foundational socio-emotional, language, and cognitive skills needed to develop healthy, adaptive coping skills" unfold for use during later stages of development (Garner, 2013 p. S65). Second, the cumulative change in the level of human capital forms a trajectory that takes its shape from unfolding biological, psychological, and social processes (Michael Rutter & Rutter, 1993). Third, human capital begets human capital. Specifically, the rate of human capital formation (i.e., the rate at which one acquires new skills) is a function of one's human capital, in the same way that small investments compound over time, such that the rate of human capital formation is a function of present value and the inputs (Heckman, 2000; Cunha & Heckman, 2007; Todd & Wolpin, 2007). Finally, accumulated human capital is what differentiates young people from adults. From a legal perspective, children hold a narrower set of rights, a distinction rooted in the idea that children are not as mature mentally or physically as adults. We do not mean to imply there is a fixed boundary that separates childhood and adulthood or that human capital investments cease once adulthood is reached. However, we note that physical, cognitive, or social emotional wellbeing, as those terms are often used in a child protection context, are not what divides childhood and adulthood. Rather, as compared to children, adults have the broad set of skills needed to be adults, as adulthood is understood in its historical and cultural context. The freedom to develop human capital may depend on physical, cognitive, and social emotional health, but the long-run developmental task involves acquiring the diverse skills needed to become an adult who manages family, community, and work.

3 A Model of Human Capital Formation

To advance the argument, we build a model consisting of four core ideas: the child, the context in which the child is raised, the risk and protective factors present in a child's life, and the trajectory that describes the formation of human capital over time. Below we lay out each idea, with the goal of describing how a human capital model fits within a child protection perspective.

3.a Person and Context

The conceptual model starts with the individual child as a biological person. The process of development is biological as reflected in the physical changes that take place between birth and school, as but one of many examples. Maturational changes are not limited to biological processes. Social and emotional changes are as much a part of maturation as physical changes are. So too is the *interaction* between developmental domains. Change, as a biophysiological, psychological process, is a natural

condition of people.

Context is the set of extra-individual influences that operate through the mechanisms of exposure. Children spend time in the presence of caregivers. Families live out their lives in a home; homes are nested within communities. Each contextual influence affects development, but the specific influence of context is a matter of what and when (Elder, 1998). For example, post-natal vulnerability to environmental stress is substantial in part because the rudimentary skills of interaction with caregivers are being formed (Shonkoff, Richter, van der Gaag, & Bhutta, 2012). There is a small but crucial set of inherent capacities that must ignite for future development to follow along a normative pathway (Walker et al., 2011). There is room for individual variation (Belsky & Beaver, 2011; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011; Ellis, Jackson, & Boyce, 2006), but the disruptive influence of exposure to early stress on skill formation and physiology during this developmental period is what seems to matter most. At later points in the life course, those same stressors, while not benign, may have a smaller or different impact because their effects are moderated/mediated by skills acquired earlier in the life course.

Figure 1 depicts the basic building blocks of the framework from a cross-sectional perspective. Context is portrayed as concentric circles to reflect the proximal/distal qualities of context relative to the individual child. The influence of context on person and person on context is bi-directional. The person-level speaks to human capital and the constructs we use to organize the narrative around the formation of human capital over the life course. As components of human capital, language skills, numeracy, motor skills and emotional self-regulation are foundational because they ignite the development of other, more diverse forms of human capital for use at later life stages (Walker et al., 2011). The contextual level speaks to the extra-individual processes that influence the rate of human capital formation. Some, if not all, of what we see over the life course is the interplay between context-, caregiver-, and child-level characteristics including his or her endowments (Cunha & Heckman, 2010; Walker et al., 2011).





3.b Risk and Protective Factors

Factors that affect human capital formation are found at the person- and contextual-levels. We can think of these factors as risk and protective factors. Risk factors adversely affect human capital

formation whereas protective factors promote human capital formation. On balance, human capital forms over time, given the equilibrium between risk and protective factors. During times when protective factors outweigh risk factors, human capital forms at a greater rate. The reverse is also true – when the risks outweigh the protective factors, the rate of human capital formation slows.¹

The model emphasizes the growth of human capital over the course of childhood. These dynamics are illustrated in Figures 2 and 3. In this case, we might imagine numeracy, literacy, motor skills, and self-regulation as components of human capital. There is, ceteris paribus, a tendency for human capital (•) to change with the passage of time because of basic bio-psychological processes, with the direction, rate and nature of change affected by the presence of protective factors (\uparrow) and risk factors (\downarrow). For example, children enter early care and education programs having already acquired certain numeracy, language, and self-regulatory skills. The level of these skills is expected to evolve but the actual rate at which new skills are acquired is a function of the base skill level, a baseline or normative rate of change, the early care and education context (e.g., program quality) plus a mix of other risk and protective factors, including the family.



Figure 2: Human Capital in the Risk / Protective Context

From measurement and conceptual perspectives, it is helpful to place human capital formation in a person-period context. Person-periods are time-bounded moments in the life of a person. These time bounded moments may be a function of age-graded regularities in the life course, such as the start of school. Or, they may be thought of as measurement occasions, as in a research context. A person starts a person-period with a set of human capital assets (Figure 2) and *may* start the next period with more human capital. The rate of human capital formation between person periods is a function of:

¹ Although the discussion focuses on the process by which human capital increases over time as a function of risk and protective factors, we understand that human capital may decline from one moment to the next because of adverse experiences. We would argue that the stock of human capital affects how adverse experiences are managed such that the rate of decline depends on the human capital. We do not elaborate on this aspect of the model here other than to acknowledge the fact that human capital trajectories are not necessarily always rising.

- The stock of human capital at the outset of the person period. Again, language is one useful example. Children start school having already mastered a certain vocabulary. This may be thought of as their stock of human capital when school starts. The vocabulary accessible at the outset of the school year raises the possibility of further language acquisition. The dynamic relationship between the human capital one has and what one acquires through time represents the autocatalytic essence of human capital or self-productivity (Aizer & Cunha, 2012; Cunha & Heckman, 2007; Heckman, 2000). In other words, human capital is its own protective factor. This direct relationship between past and current states of human capital can be described as "direct feedback loop" in the language of system dynamics. For example, children with a profound understanding of mathematical foundations at the beginning of a particular period will usually be able to grasp advanced topics more easily during later periods.
- 2. The elements of risk and protection present in the environment during the person-period. Risk and protective factors may be connected to families, communities, the service sector, and so on. Risk and protective factors are to a certain extent age-dependent in their meaning and potential influence. From a modeling perspective, the state dependencies are dynamic with respect to how person, context, and time interact.
- 3. The relationship between the stock of human capital, elements of risk and protection, and interventions and policies. Stocks of human capital acquired in one period can affect the impact of risk and protective factors, as well as policies and interventions on human capital in the next period. Dynamic complementarity or direct complementarity describe the situation where acquired skills or parental investments in a given period positively affect the impact of protective factors, interventions and policies on future human capital formation in the next period (Aizer & Cunha, 2012; Cunha & Heckman, 2007; Cunha, Heckman, & Schennach, 2010). In other words, children with higher stocks in human capital at the beginning of a period may be less affected by risk factors or more receptive to protective factors during later periods than children who have not accumulated the same level of human capital at that time.

Figure 3 provides a graphical view of what repeated measures of human capital represent conceptually. For each measurement occasion, there are measures of human capital along with measures that capture the risk/protective factors. Among other benefits, the narrative that threads these cross-sections together speaks to the impact risk and protective factors have on human capital trajectories.



Figure 3: Human Capital Trajectory in a Risk and Protective Context

Time / Development

Figure 4 looks more closely at specific person periods, building on the idea that risk and protective factors stand in relationship to the person and his or her human capital in a dynamic fashion. Some factors that fit in the risk and protective framework are proximally close to the individual, family being the best example in most cases, and others are farther away physically and psychologically, but important nonetheless. It is also the case that the influence a factor has may vary with time, context, and the developmental processes underway. Again, the idea is that human capital lies at the intersection of the risk and protective factors. In general, policies and interventions are intended to tip the equilibrium of risk and protective factors in the favor of protective factors and human capital formation. From this perspective, interventions and parenting decisions can be interpreted as protective factor investments into a child's future skill development.² In this model, the focus is on the risk/protective equilibrium as much as their presence or absence.



Figure 4: Risk and Protection as Distal and Proximal Factors*

Time / Development

* The horizontal (i.e., left to right) orientation of the risk and protective factors (i.e., the arrows) are not meant to imply a temporal ordering of risk and protective factors. Rather, the arrows represent the various distal and proximate influences on human capital within the person-period. Also, the relative weight of the arrows suggests that some influences are more important than others.

4 A Formal Model of Human Capital Formation in the Child Protection Context

As a next step, we implement the model of human capital formation in child protection settings within a formal scientific approach. More precisely, we formulate skill development during childhood and adolescence using an approach that has become standard for lifecycle models in the literature on cognitive and noncognitive skill formation (Todd & Wolpin, 2003; Heckman, 2007; Cunha & Heckman, 2008; Aizer, & Cunha, 2010; Almond & Currie, 2010; Almond et al., 2017), with

² As the focus of this article is the introduction of the concept of human capital formation as a framework for child protection outcomes, we will not discuss parental decision processes. For a treatment of parental investment decisions in the context of human capital formation see Cunha, Heckman, & Schennach (2010).

specific reference to the work by Cunha et al. (2010).

These models describe the formation of skills along a time axis, usually periods of childhood (Heckman, 2006, 2007; Almond & Currie, 2010; Almond et al., 2017). In our model we focus on children's age and will therefore describe the periods of childhood (including adolescence) by the index a, where $a \in$ $\{0, 1, \dots, A\}$. As illustrated in Figure 3, each child is born (a = 0) with a certain set of characteristics and an initial stock of cognitive (C) and non-cognitive (N) skills, $\theta_0 = \{\theta_0^C, \theta_0^N\}$, that are influenced by children's family, contextual, and service environments (e.g., Patton et al., 2018). To highlight the fact that a parent's human capital and skill set directly influences the skills and human capital formation of their offspring, we will differentiate between parents' cognitive and noncognitive skills at time of the child's birth, $\theta_0^P = \{\theta_0^{P,C}, \theta_0^{P,N}\}$, and other family (P), contextual (E), and service influences (S), $I_0 =$ $\{I_0^P, I_0^E, I_0^S\}$. In contrast to the model by Cunha et al. (2010), we allow parents' skill set to develop over time so that $\theta_a^P = \{\theta_a^{P,C}, \theta_a^{P,N}\}$, where $a \in \{0, 2, ..., A\}$. This is necessary as the child protection system operates across two dimensions of intervention that are not mutually exclusive, child protective interventions and services directly targeting the child (e.g., interventions targeting problem behaviors in children or out-of-home care placements), and family preservation interventions and services that target children's family environment (e.g., parenting interventions or mental health services for parents). To keep the notation simple we will define the vectors of children's skills in a particular period as $\theta_a = \{\theta_a^C, \theta_a^N\}$ and risk and protective factors in this period as $I_a = \{I_a^P, I_a^E, I_a^S\}$, where $a \in$ $\{0, 2, \dots, A\}.$

To formally express the formation of skills from one period to the next, we will amend the statedependent model by Cunha, Heckman, & Schennach (2010) to accommodate the child protection context.

$$\theta_{a+1}^{l} = f_{d}^{l} \Big(\theta_{a}, I_{a}^{l}, \theta_{a}^{P}, \xi_{a}^{l} \Big) \quad , l \in \{C, N\}, a \in \{0, 1, \dots, A\}, d \in \{1, 2, \dots, D\}$$
(1)

Hereby *a* denotes the age of the child at which measurement is conducted, *l* is an index that identifies whether the skill is cognitive (C) or non-cognitive (N) and $f_d^l(\cdot)$, with $l \in \{C, N\}$ and $d \in \{1, 2, ..., D\}$, represents the skill-specific (i.e., cognitive or non-cognitive) function linking risk and protective factors as well as parental skills and previously accumulated skills to future stocks of skills. The index *d* highlights that this relationship between inputs and future skills can change along children's developmental stages.³ The ξ_a^l represent unobserved factors, inputs or random shocks during that particular period.

Figure 5 illustrates the model of skill formation in equation (1) as a dynamic process where we assume only one risk (indexed by r) and one protective (indexed by g) factor at the Parent (P) and Service (S) level. The solid black arrows in Figure 5 indicate the causal relationships expressed in equation (1) while the dotted grey arrows indicate a model of relationships among skill, risk and protective factors and highlight the complex relationships between all elements. For example, Belsky (1984) describes a model

³ Following (Cunha et al., 2010), we also assume $f_d^l(\cdot)$ to be monotone increasing and twice continuously differentiable in its arguments and concave in I_a^l .

of the determinants of parenting that could help to explain how risk and protective factors at the Parent level are related to each other and to child development. Belsky's model also includes context level factors as determinants of parenting but we exclude complex interactions between inputs across levels in order to keep the graph manageable since the process of interest is expressed by equation (1).



Figure 5: Dynamic Process of Child Skill Development

Based on the model at the center of equation (1), we can proceed to identify the parameters of the formation of cognitive and noncognitive skill over the course of a child's life. Self-productivity in this model arises if skills acquired in the past increase the accumulation of skills in future periods. This is represented by taking the first derivate of equation (1) with respect to the lagged skills acquired by time period a-1 (θ_a). In other words, self-productivity requires that (Cunha & Heckman, 2007, p.36):

$$\frac{\partial f_{a}^{l}(\theta_{a}, l_{a}^{l}, \theta_{a}^{P}, \xi_{a}^{l})}{\partial \theta_{a}} > 0 \quad , l \in \{C, N\}, a \in \{0, 1, \dots, A\}, d \in \{1, 2, \dots, D\}$$
(2)

Dynamic complementarity, on the other hand, represents the positive impact of acquired skills on the effects of risk or protective factors in future human capital formation (Heckman, 2007). Formally, dynamic complementarity implies that (Cunha & Heckman, 2007, p.36):

$$\frac{\partial^2 f_d^l(\theta_a, I_a^l, \theta_a^P, \xi_a^l)}{\partial \theta_a \partial I_a^l} > 0 \quad , l \in \{C, N\}, a \in \{0, 1, \dots, A\}, d \in \{1, 2, \dots, D\}$$
(3)

In other words, dynamic complementarity implies that the rate of skill formation with reference to a particular risk or protective factor is influenced by previously accumulated skills. Furthermore, using the process of skill formation in equation (1), we can identify sensitive and critical periods of risk and protective factors as described in (Cunha & Heckman, 2007, p.37). Critical and sensitive periods highlight the developmental stages during which risk and protective factors have the most profound impact on a child's skill development process. These insights are crucial to ensuring that children receive the appropriate services at the right time as emphasized by Elder (1998).

Ultimately, we are interested in the stock of human capital at the time that the child transitions to

adulthood (Courtney, 2009; Keller, Cusick, & Courtney, 2007), although transitions at any point along life course (e.g., starting school) are similarly important parts of the theoretical framework. In this context, the stock of human capital (Y_{A+1}) is a function of cognitive and noncognitive skills (Cunha et al., 2010; Heckman, 2007):

$$Y_{A+1} = m\left(\theta_{A+1}^C, \theta_{A+1}^N\right) \tag{4}$$

Assuming a particular specification of the functional relationships in equations (1) and (4), we can also derive an elasticity of substitution between risk and protective factors during a particular stage of the skill formation process and between sets of skills of adult human capital (see Cunha et al., 2010). However, a detailed discussion of this topic is beyond the scope of this article. In the next section, we will provide an example of the implementation of the process of skill formation in equation (1) within a statistical framework.

5 Formulating Child Development as an Ecological Model

In general, a framework should connect explicit theories with statistical models that provide a way to test the theory (Reiss & Wolak, 2007; Collins, 2006). In this case, the theory being applied connects change in human capital to the individual child and the context in which that child's life course unfolds. The theory also connects changes in caregiving contexts to those same individual as well as other contextual factors. Together, the two views reveal how context affects development and how development shapes context. In this section we will implement the theoretical model from equation (1) within a statistical framework. Before we provide a specification of the statistical model, we discuss the foundation of any statistical analysis, data collection.

5.a Measurement and data structure in an ecological model of human capital formation

Figure 6 presents the model described in previous sections in a person, place, and time structure. Time in this case is along the z-axis. Development happens through time, with the changes in human capital forming a life course trajectory through the state-space portrayed in Figure 6. Along the x-axis are the developmentally homogeneous age groupings that fit with the notion of expectable age-graded progressions. They share a starting point in the state-space based on something the members share. Analytically, it is important to see how the narrative unfolds from that common starting point for the groups of children organized that way. Birth is the most obvious starting point, but other starting points are also important from a policy and practice perspective.⁴ From that shared starting point, children experience life going forward. The y-axis represents the family context in which those lives went forward. There are other ways to represent context. The choice here – family settings – represents an

⁴ From a child protection policy perspective, commencement of foster care placement could be a starting point of interest because, contrary to the education literature, foster care results in a caregiver change and therefore a potential change in the parental investment function. Parenting skills or parental investments are a function of parent, child and contextual factors (Belsky, 1984) and consequently, a change in caregivers may result in a change in parenting decision processes related to children's human capital formation.

important proximal influence as the *place* where a child grows up. In the model, place may be physical, administrative, social or psychological. Communities, families, homes, and service agencies all fit within this notion of settings where children and young people live out some aspect of their lives.



Figure 6: Human Capital in Person, Place and Time

When arrayed in a person-place-time structure, the person-periods form the building blocks of life course narrative. What remains is measurement – what does one need to know about each person-period to make sense of the interlocking experiences? A basic measurement strategy starts with the child as the basic unit of interest. Other units of analysis are important but human capital formation at the child level is fundamental. Children (*i*) are described in terms of their biographical information such as gender, date of birth, race/ethnicity, their physical health, their social/emotional health, their cognitive development, their experiences and their skills. Skills, which are age- and context-sensitive in their meaning, are interpreted broadly to include the relational skills that are an important part of development along with education, know-how, and experience. Human capital ties these skills together into a bundle of assets the young person uses to navigate the transitions that lie ahead. How young people cope with the expectable progressions of their lives, using their human capital, is the narrative captured with these data. When children are old enough, the data collected represent their own reflections or perceptions (Schafer, Ferraro, & Mustillo, 2011).

Each measurement occasion also represents an opportunity to learn about context (*j*). Conceptually, context is most efficiently thought of as layered, with some layers coming closer to the person than others. Parents are interesting because caregivers play such an important, proximal role in childhood. Through their interactions (i.e., their investments) with children, caregivers are both a direct and mediating/moderating influence on the developing child. Knowing who the caregivers are, at what point in the life course, and in what context the caregivers are providing care helps us understand the narrative. In the model, home is a physical and psychological construct and so too is community. When the State becomes involved in shaping the context, the benefits of its involvement says something about how well the system of policy, finance, and services comes together as a coherent system responsive to the needs of children, families, and communities.



Figure 7: Measurement Constructs: What is Measured at Each Occasion

To this last point, the measurement occasions also provide a window into the services (*k*) children and caregivers receive. The structures that define the service system are part of context. What these data represent conceptually is whether children and families receive services from those systems. The quality of the services provided is also of interest. Services are divided in their respective clusters: school, health, and child welfare. The data should capture the service history in its temporal order so that it too can be woven together with what happens developmentally.

The last cluster of important data covers maltreatment history. Among the adverse childhood experiences affecting children, child maltreatment is singled out in a child protection context. If families are a bedrock of human capital, it is because they offer a place to grow up where the protective contributions to human capital formation outweigh the risk factors. Children are safe there, with spillover effects in other human capital domains..

To illustrate how the model of equation (1) works, we have selected an example that considers changes in human capital measured as language skills, child-level effects that influence the rate at which words are learned, and contextual effects tied to place.⁵ In this case, place refers to a community, as it often does. We are interested in whether human capital forms at rates that differ by community because the reasons behind that form of variation may offer clues regarding service improvements worth trying.

However, implementing the process described in equation (1) can prove to be difficult for several reasons as many of the driving factors may not be observed, measured with error, or the available data is riddled by missing values (Todd & Wolpin, 2003, 2007). To facilitate identification in these complex

⁵ For readers interested in how caregiver and youth characteristics interact (Figure 6), the analysis of caregiver/child dyads follows the same statistical argument (Campbell & Kashy, 2002; McMahon, Pouget, & Tortu, 2006).

models, empirical studies often assume the process shown in equation (1) to be linear and we will follow this literature in the remainder of this section (Aizer & Cunha, 2012; Cunha & Heckman, 2008; Todd & Wolpin, 2007).⁶ In general, not all factors influencing language development will be available to the researcher and as such the nested structure of the data has to be considered for multiple reasons. First, the nested structure in our ecological model is not merely a statistical nuisance. Rather the variation in parameters as a function of nested structure is often linked to practical policy and programmatic insights. Secondly, if the unobserved effects are related to covariates included in the statistical model, then ignoring the hierarchical structure of the data will lead to inconsistent estimates of the parameters. Finally, if our theory of skill formation assumes dynamic complementarity and self-productivity, ignoring unobserved effects at the child and community level can result in significant bias of the estimated parameters.

To emphasize the focus on an ecological model of child development and human capital formation, we will present the statistical model of this example as a hierarchical linear model (Raudenbush & Bryk, 2002) as this presentation should be familiar to most readers. To keep notation simple, we will assume only one risk or protective factor at each level of the model.

5.b Measurement Occasions as the Base Level (Level 1)

The statistical specification of human capital formation is based on multiple measurement points for each child, here annually. As such, measurement occasions are the unit of observation and form the first level of the hierarchical model. From a statistical perspective, longitudinal data are comparable to hierarchical datasets, with individual measurement points being clustered within a single child. Hence the statistical specification of longitudinal datasets with multiple data points can be directly integrated within the hierarchical model.

$$Y_{(a+1)} = \beta_{0ij} + \beta_{1ij}Y_{ija} + \beta_{2ij}X_{ij(a+1)} + \beta_{3ij}Y_{ija}X_{ij(a+1)} + \sum_{a=1}^{A} \tau_{(a+1)}Time_{(a+1)} + \varepsilon_{ij(a+1)}$$
(5)

Insofar as the basic unit of interest is the child, we start by asking how changes in language unfold. Language ability is multidimensional (Sylvestre, Bussières, & Bouchard, 2016), so in the interest of simplicity we will model changes in the number of spoken words per person-period. At each measurement occasion, we expect the number to rise relative to earlier measurements, in part because growth and development is governed by inherent bio-psychological processes but also because risk and protective factors influence the acquisition of new words. To stay connected to the overarching argument, the changes from one person-period to another in the number of spoken words is the measure of human capital and the ensuing trajectory is the process of human capital formation. Moreover, we expect language development to be adversely affected by maltreatment (Allen & Oliver, 1982; Spratt et al., 2012; Sylvestre & Mérette, 2010)

⁶ The linear specification of the skill formation process is a special form of the constant elasticity of substitution function often used in the economic literature on human capital formation (Almond, Currie, & Duque, 2017). For a discussion of the estimation of models relaxing the linear assumption and also accounting for measurement errors, we refer interested readers to Cunha et al. (2010).

 $Y_{(a+1)}$ is a measure of human capital for child *i* in community *j* at discrete time or age (*a+1*). β_0 is the model intercept for child *i* in community *j*. Y_a refers to accumulated human capital during the previous period (*a*) and the coefficient β_1 captures self-productivity, the contribution of previously accumulated skills to the formation of skills in the next period. Y_0 refers to the human capital at birth if *a* represents ages, so it represents initial stock of skills. As such, the human capital formation is expressed as a continuous and cumulative process depending on historical and contemporaneous factors as well as the baseline of lagged stocks of skills.⁷ Historical and contemporaneous factors cannot capture child's genetic endowment; however, the inclusion of the first lagged human capital variable can absorb prior unobserved experiences as well as genetic endowment.

 $X_{(a+1)}$ is an age-varying risk or protective factor for child *i* in community *j* that may change from measurement point to measurement point. At this level, the individual factors group into risk and protective factors plus already accumulated human capital. Protective factors are associated with positive coefficients. Risk factors have negative coefficients.

Equation (5) also includes an interaction term between the lagged stock of human capital and the current period risk/protective factor. Therefore, the coefficient β_{3ij} captures dynamic complementarity, the effect of previously accumulated skills on risk and protective factors in the following period.

Time_(a+1) represents the fixed effect of time (age) on children at each discrete measurement time except time 0. In other words, $\tau_{(a+1)}$ estimates the change in human capital at discrete time intervals (i.e., person-periods) relative to the model intercept and when $\tau_{(a+1)}$ is arrayed against time on the x-axis, the model produces the human capital trajectory as portrayed in Figures 2 and 3. The intercept (the number of words at time 0) is represented in Figure 2; Figure 3 shows the trajectory through time. The functional form of the heterogeneous trajectories (for each child *i*) is how human capital tends to form from the baseline (or intercept). Finally, the term $\varepsilon_{(a+1)}$ captures any time-varying unobserved effects and are assumed to be independent of the covariates included in equation (5).

5.c The Child Level Model (Level 2)

As is typical for longitudinal data, several observations (level 1) are available for a single child (level 2). Consequently, observations for a particular child are expected to be more closely aligned to each other than observations for different children. From a multilevel perspective this results in a hierarchical model where observations are clustered within a child. Differences in the intercept of equation (5), represented by β_0 , refer to the average level of human capital for the observations nested within the *i* children in community *j*. The level-2 model can be represented in the following general form (Raudenbush & Bryk, 2002):

$$\beta_{pij} = \delta_{p0j} + \delta_{p1j} C_{ij} + \gamma_{pij}, \ p \in \{0, 1, 2, 3\}, i \in \{1, 2, \dots, N\}, \ j \in \{1, 2, \dots, J\}$$
(6)

At level 2, the coefficients of level 1 (β_{0ij} , β_{1ij} , β_{2ij} and β_{3ij}) are seen as outcomes, which are related to variables at higher levels. For example, β_{0ij} refers to the intercept in human capital for child *i* in community *j*; β_{1ij} , β_{2ij} and β_{2ij} refer to the slope for child *i* in community *j* associated with Y_{ija} , X_{ija+1} , and Y_{ija}

⁷ This can easily be shown by iterative substitution in the recursive model in equation (1).

 X_{ija+1} , respectively. All the coefficients (β_{0ij} , β_{1ij} , β_{2ij} and β_{3ij}) include child level fixed variables, C_{ij} , so that β_{0ij} becomes the adjusted intercept and β_{1ij} , β_{2ij} and β_{3ij} become the adjusted slopes for child *i* in community *j*. δ_{00j} represents the intercept for community *j* and δ_{01j} represents the main effect for time-invariant, child-level covariate (C_{ij}) in community *j*. Similarly, δ_{20j} captures the main-effect of the level-1 time-varying covariate X_{ija+1} for community *j* while δ_{21j} represents the interaction between the level-1 time-varying risk/protective factor (X_{ija+1}) and the level-2 time-invariant risk/protective covariate ($C_{i,j}$) in community *j*. Therefore, δ_{20j} and δ_{21j} capture the adjusted slopes in human capital for community *j* in a different way - main effect and cross-level interaction effect. The interpretation of the other coefficients follows the same logic. Despite the similarity of δ_{00j} , δ_{10j} , δ_{20j} and δ_{30j} regarding the main effects, δ_{00j} indicates different community intercepts and δ_{10j} , δ_{20j} and δ_{30j} indicate different community slopes, which will be explained in detail in level-3. Also, δ_{01j} indicates intercept effects of C_{ij} and δ_{11j} , δ_{21j} and δ_{31j} indicate covariate effects of C_{ij} . As such, the inclusion of C_{ij} makes β_{0ij} as the adjusted intercepts for child *i* in community *j*. As a result, the time-invariant $C_{i,j}$ can have an impact on human capital through both direct effects on the intercepts and interaction effect.

The γ_{pij} represents any unobserved factors that generate variation in child *i*'s level-1 coefficients after accounting for C_{ij} . A subscript of *i* in γ_{pij} indicates that each child has a unique intercept and a slope because of two different random components: random intercepts (γ_{0ij}) and random slopes (γ_{1ij} , γ_{2ij} , γ_{3ij}). The existence of γ_{0ij} makes this model a random effects model, which allows the child intercepts to vary. In addition, the existence of γ_{1ij} , γ_{2ij} , γ_{3ij} extends this model to the random coefficients model, which allows level-1 slopes to vary randomly by child. The random coefficients model therefore allows both child intercepts and child slopes to vary randomly. Practically, it may be challenging to have random coefficients for all level-1 coefficients. As such, a more concise model will be presented later after building the full random coefficients model. In general, these unobserved effects are assumed to be independent from X_{ija} and C_{ij} and to be multivariate normally distributed with mean 0 and covariance matrix Σ (Raudenbush & Bryk, 2002). The reference to *j* different communities in equation (6) is a reminder to consider that the parameters vary by community. These contextual effects are taken up in the next section.

5.d The Context Model (Level 3)

If context has an effect on human capital and human capital formation, the effects are realized as variation in the intercept of the level-2 model, effects on the slope of the level-2 covariates, or both. Differences in the intercepts (δ_{00j}) suggest that there are differences in the average level of human capital among the children clustered by the community organizing their services. Level-3 covariates are used to explain the between-community differences in a model. When the other coefficients (δ_{10j} , δ_{20j} , δ_{30j} , δ_{01j} , δ_{11j} , δ_{21j} , δ_{31j}) vary it means that there exist interactions between context variables and covariates at lower levels of the model. In other words, the effects of level-1 and level-2 risk and protective factors depend on the context.

As an example, in the risk/protective framework, the relationship between age and vocabulary depends on attributes measured at the contextual level. Each level-3 coefficient can therefore be represented by

the following general model:

$$\delta_{pqj} = \theta_{pq0} + \theta_{pq1} Z_j + \eta_{pqj}, \quad p \in \{0, 1, 2, 3\}, q \in \{0, 1\}, j \in \{1, 2, \dots, J\}$$
(7)

Where, for example, δ_{00j} is the intercept for the community *j* in equation (6) and θ_{000} is the average intercept across communities. If δ_{00j} also includes community-level fixed variables (Z_j), then δ_{00j} becomes the adjusted intercept for community *j*. As an example of how attributes of the community affect human capital, θ_{001} should be considered. It is the adjusted difference in human capital associated with community variables. Children served by some communities (due to a community covariate) may know more (or fewer) words than children in other communities for reasons having to do with the fact that children who have similar backgrounds and demographics tend to live together. This is captured by θ_{001} .

How community-level covariates influence human capital formation through their relationships with covariates at lower levels (level-1 and level-2 risk and protective factors) is captured by the other coefficients in equation (7). For example, δ_{10j} , δ_{20j} , and δ_{30j} refer to the slope of time-varying covariates for community *j*. When δ_{10j} , δ_{20j} , and δ_{30j} include Z_j , then those δ_{10j} , δ_{20j} , and δ_{30j} become the adjusted slopes associated with community variables Z_j . Regarding the difference between (θ_{100} , θ_{200} , θ_{300}) and (θ_{101} , θ_{201} , θ_{301}), the former are adjusted slopes of children associated with time-varying covariates, while the latter are the adjusted slopes of children associated with the interactions between community variables and child time varying covariates.

The level-2 coefficients δ_{11j} , δ_{21j} , and δ_{31j} represent the interactions between the level-1 time-varying risk/protective factors and the level-2 time-invariant risk/protective covariates ($C_{i,j}$). If δ_{11j} , δ_{21j} , and δ_{31j} include Z_j , then those δ_{11j} , δ_{21j} , and δ_{31j} capture the adjusted slopes associated with community variables Z_j . Regarding the difference between (θ_{110} , θ_{210} , θ_{310}) and (θ_{111} , θ_{211} , θ_{311}), the former refers to the adjusted slopes of human capital associated with the cross-level interactions between level-1 and level-2 variables and the latter capture the adjusted slopes associated with the three-way cross-level interactions of level-1 variables, level-2 variables and community variables.

The existence of community residual η_{ooj} makes this model a three-level random effects model and if we assume the level-2 slopes to randomly vary as well, then the inclusion of other community-level residuals makes this model a three-level random coefficients model. The random coefficients model allows the community slopes to differ randomly by community. Community intercepts and community slopes are usually assumed to be multivariate normally distributed with a mean of zero and general variance-covariance matrix. Individual community random values (both intercepts and slopes) are, therefore, deviations from zero.

5.e Estimating the parameters of human capital formation

Although the full statistical model is presented as a three-level random coefficients model for completeness, it is unlikely that all the parameters in the model can be identified and estimated in practical settings. Consequently, identification of the model will require us to make some assumptions, which will depend on the exact research question of the study and our understanding of the true skill formation processes. In the remainder of this section we will focus on random intercept models and will

not discuss random coefficients. More precisely, we assume that β_{1ij} and β_{3ij} are fixed (i.e., do not vary at across children and context), that β_{2ij} , δ_{20j} , and δ_{21j} are all non-randomly varying, and that η_{01j} is a constant and zero. To avoid higher level interaction effects in our model, we also restrict θ_{211} to zero. This results in the simplified specification:

$$Y_{(a+1)} = \theta_{000} + \beta_1 Y_{ija} + \theta_{200} X_{(a+1)} + \beta_3 Y_{ija} X_{(a+1)} + \theta_{010} C_{ij} + \theta_{001} Z_j + \theta_{210} X_{(a+1)} C_{ij} + \theta_{201} X_{(a+1)} Z_j + \sum_{a=1}^{A} \tau_{(a+1)} Time_{(a+1)} + \gamma_{0ij} + \eta_{00j} + \varepsilon_{ij(a+1)}$$
(8)

One way of estimating the parameters in equation (8) is to assume that γ_{oij} and η_{ooj} are constants of value zero (i.e., there is no random variation in the intercepts). This is also the standard approach of the change in score model. Based on this assumption, the model can easily be estimated by ordinary least squares. However, this model requires some strong assumptions that are not reasonable based on the theoretical model in equation (1). Consequently, different methods are required to account for the unobserved heterogeneity at child and context levels. Unfortunately, the dynamic structure of the model renders the estimates from standard approaches such as random effects and fixed effect models inconsistent. This is because the unobserved level-2 and level-3 error terms are, by definition, related to the lagged dependent variable, a violation of the key assumptions for random effect models. On the other hand, eliminating the unobserved factors as is done in fixed effect models causes a different endogeneity problem since differences in the lagged term are correlated with the difference in level-1 errors (see Wooldridge, 2010).

If we are only interested in level-1 parameters and ignore dynamic complementarity (i.e., $\beta_3 = 0$), then the hierarchical model in equation (8) can be re-written as:

$$Y_{(a+1)} = \theta_{000} + \beta_1 Y_{ija} + \theta_{200} X_{(a+1)} + \theta_{010} C_{ij} + \theta_{001} Z_j + \theta_{210} X_{(a+1)} C_{ij} + \theta_{201} X_{(a+1)} Z_j + \sum_{a=1}^{A} \tau_{(a+1)} Time_{(a+1)} + \gamma_{0ij} + \eta_{00j} + \varepsilon_{ij(a+1)}$$
(9)

The parameters related to level 1 in equation (9) can then be consistently estimated using methods appropriate for linear dynamic models (see Hsiao, 2014).⁸ However, this is just one example of a wide range of possible specifications to estimate parameters of equation (1).⁹ The most appropriate specification will depend on the exact research question and the data that the analyst has available.

6 Implications and Discussion

As an idea, child well-being has broad appeal especially in the context of child protection. The state intervenes in families because the well-being of children is at risk. Naturally, we want children to do

⁸ Widely applied methods for estimation of dynamic effects are based on differencing out the unobserved heterogeneity and subsequently using an instrumental variable approach where higher-order lagged differences or levels of the outcome variable are used as instruments (see Hsiao, 2014). Therefore, time-invariant variables will also be differenced out and parameters of level-2 and level-3 equations will not be estimated using these methods (except interaction terms with level-1 covariates).

⁹ We refer the reader to the relevant literature for further examples of the implementation of models of human capital formation (e.g., Todd & Wolpin, 2007; Cunha & Heckman, 2008; Cunha, Heckman, & Schennach, 2010; Aizer & Cunha, 2012)

well and their chances of doing well should not be adversely affected by their parents or the State in the event children are placed away from home. Within child protection policy and practice contexts, child well-being is the term of art that captures the impulse to think beyond safe and stable families.

Despite its common-sense appeal, the reality is that well-being is difficult to operationalize within a child protection context (Wulczyn, Barth, Yuan, Harden, & Landsverk, 2005). Viewed strictly from a policy and practice perspective, it isn't entirely clear how child well-being, as a developmental construct, fits within a traditional child protection mandate. For example, it is clear that violence adversely affects children. If violence arises within the family in the form of physical abuse by a parent, child protection agencies have clear jurisdiction. If the violence emanates from the community where the family is living, the jurisdiction of the child welfare agency is equally clear. Absent an act of commission or omission by a care giver, community violence will not draw the attention of the child protection agency on a case-specific basis. The harm to the child's well-being may be equally adverse, but the specific response falls outside the child protection realm.¹⁰ In sum, child well-being is a multi-dimensional construct affected by a range of risk and protective factors, both within and outside the family system. To be concerned about child well-being is to be concerned about the whole child, development over the life course, and all the risk and protective factors that affect how children grow into adults.

A related problem has to do with well-being as a rather fuzzy analytical construct. As Ryan and Deci (2001) note, the interest in well-being sometimes prompts questions that ask whether someone is happy and why some people are happier than others? These questions yield what might be called point estimates of well-being. Alternatively, others are interested in understanding how happiness today is related to happiness yesterday and happiness tomorrow. This view aligns more tightly with the idea that well-being is a person-centered, developmental construct, subject to ebbs and flows such that the well-being trajectory, rather than a point estimate, is what matters most. Of course, some scholars would take issue with equating happiness and well-being, but that debate only adds to the mercurial nature of what we mean when we raise the issue of well-being.

In this paper, we make the argument that human capital and human capital formation ought to occupy a central place in the common-sense but nevertheless contentious discussions about the proper place of well-being in a child protection context. As an organizing heuristic, human capital offers certain conceptual advantages over the more widely used term well-being. When defined broadly to include a diverse range of skills applied in diverse contexts that arise over the life course, human capital formation answers the *freedom to* question at the heart of policy: children should be *free from* adverse experiences so that they are *free to* develop the human capital needed to succeed first as children and then as adults. Importantly, in this context, human capital as a foundation of success reaches across domains into family life, citizenship, and the world of work when the time comes. Put simply, skills matter.

Human capital offers other conceptual advantages as well. Although conversations about well-being often invoke the idea that well-being is its own protective factor, formal models that integrate a

¹⁰ A child welfare/child protection agency may, of course, take action to reduce violence at the community level as part of a prevention strategy.

dynamic view of well-being alongside other risk and protective factors are not well developed in the child protection context. As we point out, human capital formation begins early in life as the foundational skills of social emotional regulation, numeracy and literacy take shape through interactions with care givers and the environment, eventually giving way to the broad skill set needed to navigate life course transitions, whether those transitions are conceptualized as moving from middle school to high school, moving from one foster care setting to another, or any of the myriad other transitions children encounter. Successful adjustment is tied to the risk and protective factors present plus the skills one has at their disposal to manage the challenges ahead.

Human capital also provides a useful outcome framework for managing public policy from a whole-ofgovernment perspective (NYC Children's Cabinet, 2016). In the U.S., the child protection framework places well-being, defined generally as cognitive, social-emotional, and physical health, *alongside* safety and permanency. It is, ultimately, an awkward juxtaposition because it creates a conceptual separation that breaks down when laid out analytically. For example, given the importance of a safe and stable family to the well-being of a child, it is more analytically productive to think about safety and permanency as risk and protective factors that influence developmental trajectories. In other words, safety and permanency occupy different parts of the causal model tied to well-being.

If, as an alternative, we substitute human capital for the more generic term well-being, then the model links safety, permanency, cognitive, physical, and social emotional health (among other assets) to the skills young people need to move forward in their lives. It is a whole-of-government view because the human capital trajectory is subject to diverse influences that cut across bureaucratic silos. If we want children to do well, we have to tip the risk and protective balance toward protective factors including the child's own human capital. Children have a hand in that as do families, communities, and *all* the government agencies that, through their policies and programs, represent our collective investment in children.

The model we propose – the structural model and its statistical analog – is meant to guide research that explicitly tests these ideas and their applicability to child protection. Although we restricted the discussion of human capital formation to the skill development process of children, we also want to acknowledge that risk and protective factors as well as policies and interventions can be interpreted as decision processes that are also influenced by a variety of factors (e.g., income, needs assessment tools, time restrictions). When discussing human capital formation as an outcome framework for children in child protection systems, it becomes natural to extend the model to include parental decision processes, child protection interventions, and other services as interrelated *investment* processes. From this perspective, it becomes possible to develop a model of service optimization (i.e., public investment in children) along the lifecycle of children. Such models also capture interesting and important two-generation/intergenerational effects on human capital formation.

In sum, human capital and human capital formation provide an integrated framework that organizes the biological, physiological, and psychological processes of development inside a risk and protective context that values what a child has already accomplished as a factor tied *directly* to how well a child will do in the future. As a way of thinking about what child protection systems contribute to a dynamic

model of development, human capital and human capital formation place safe and stable families at the center of whole-of-government efforts to support vulnerable children.

7 References

Aizer, A., & Cunha, F. (2012). *The production of human Capital: Endowements, investments and fertility* (National Bureau of Economic Research Working Paper Series No. 18429). Cambridge, MA: National Bureau of Economic Research. Retrieved from http://www.nber.org/papers/w18249

Allen, R. E., & Oliver, J. M. (1982). The effects of child maltreatment on language development. *Child Abuse & Neglect*, *6*, 299–305.

Almond, D., & Currie, J. (2010). *Human capital development before age five* (National Bureau of Economic Research Working Paper Series No. 15827). Cambridge, MA: National Bureau of Economic Research. Retrieved from https://www.nber.org/papers/w15827.pdf

Almond, D., Currie, J., & Duque, V. (2017). *Childhood circumstances and adult outcomes: Act II* (National Bureau of Economic Research Working Paper Series No. 23017). Cambridge, MA: National Bureau of Economic Research. Retrieved from <u>https://www.nber.org/papers/w23017.pdf</u>

Attanasio, O. P. (2015). The Determinants of Human Capital Formation During the Early Years of Life: Theory, Measurement, and Policies. *Journal of the European Economic Association*, *13*, 949–997.

Becker, G. (1964). Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. Chicago, IL: The University of Chicago Press.

Belsky, J. (1984). The Determinants of Parenting: A Process Model. *Child Development*, 55(1), 83–96. https://doi.org/10.2307/1129836

Bierman, K., Domitrovich, C., Nix, R., & Gest, S. (2008). Promoting Academic and Social-Emotional School Readiness: The Head Start REDI Program. *Child Development*.

Bowles, S., Gintis, H., & Osborne, M. (2001). The Determinants of Earnings: A Behavioral Approach. *Journal of Economic Literature*, *39*, 1137–1176.

Collins, L. M. (2006). Analysis of Longitudinal Data: The Integration of Theoretical Model, Temporal Design, and Statistical Model. *Annual Review of Psychology*, *57*(1), 505–528.

Courtney, M. E., & Heuring, D. H. (2005). The Transition to Adulthood for Youth "Aging Out" of the Foster Care System. In D. W. Osgood, E. M. Foster, C. Flanagan, & G. R. Ruth (Eds.), *The John D. and Catherine T. MacArthur Foundation Research Network on Transition to Adulthood. On your own without a net: The transition to adulthood for vulnerable populations* (pp. 27-67). Chicago, IL, US: University of Chicago Press.

Courtney, M. E. (2009). The Difficult Transition to Adulthood for Foster Youth in the US: Implications for the State as Corporate Parent and commentaries. Social Policy Report (Vol. 23, pp. 1–20). Wiley-

Blackwell.

Cunha, F., & Heckman, J. J. (2007). The Technology of Skill Formation. *American Economic Review*, *97*(2), 31–47. https://doi.org/10.1257/aer.97.2.31

Cunha, F., & Heckman, J. J. (2008). Formulating, Identifying and Estimating the Technology of Cognitive and Noncognitive Skill Formation. *Journal of Human Resources*, *43*(4), 738–782. https://doi.org/10.3368/jhr.43.4.738

Cunha, F., & Heckman, J. J. (2009). Investing in Our Young People. *Rivista Internazionale Di Scienze Sociali*, *117*(3/4), 387–417.

Cunha, F., Heckman, J. J., & Schennach, S. M. (2010). Estimating the Technology of Cognitive and Noncognitive Skill Formation. *Econometrica*, *78*(3), 883–931. https://doi.org/10.3982/ECTA6551

Deming, D. (2017). The Growing Importance of Social Skills in the Labor Market. *The Quarterly Journal of Economics*, *132*, 1593–1160.

Elder, G. H. (1998). The Life Course as Developmental Theory. Child Development, 69, 1–12.

Elias, M. J., Zins, J. E., & Graczyk, P. A. (2003). Implementation, sustainability, and scaling up of socialemotional and academic innovations in public schools. *School Psychology Review*, *32*, 303–319.

Fantuzzo, J., Bulotsky, R., McDermott, P., & Mosca, S. (2003). A Multivariate Analysis of Emotional and Behavioral Adjustment and Preschool Educational Outcomes. *School Psychology Review*.

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N.
O. (2012). Teaching Adolescents to Become Learners: The Role of Noncognitive Factors in Shaping
School Performance--A Critical Literature Review. Chicago, IL: The University of Chicago Consortium on
School Research.

Heckman, J. J. (2000). Policies to foster human capital. *Research in Economics*, 54(1), 3–56. https://doi.org/10.1006/reec.1999.0225

Heckman, J.J. (2006). Skill Formation and the Economics of Investing in Disadvantaged Children. *Science*, *312*, 1900–1902.

Heckman, J. J. (2007). The Economics, Technology, and Neuroscience of Human Capability Formation. *Proceedings of the National Academy of Sciences of the United States of America*, *104*(33), 13250–13255.

Heckman, J. J. (2008). Schools, skills, and synapses. *Economic Inquiry*, *46*(3), 289–324. https://doi.org/10.1111/j.1465-7295.2008.00163.x

Heckman, J. J., & Conti, G. (2012). *The Economics of Child Well-Being* (No. 18466) (pp. 1–58). Washington, DC: National Bureau of Economic Research.

Heckman, J. J., & Kautz, T. (2012). Hard evidence on soft skills. *Labour Economics*, 19, 451–464.

Hsiao, C. (2014). Analysis of panel data (3rd ed.). New York, NY: Cambridge University Press.

Keller, T. E., Cusick, G. R., & Courtney, M. E. (2007). Approaching the Transition to Adulthood: Distinctive Profiles of Adolescents Aging out of the Child Welfare System. *Social Service Review*, *81*, 453–484.

Patton, G. C., Olsson, C. A., Skirbekk, V., Saffery, R., Wlodek, M. E., Azzopardi, P. S., et al. (2018). Adolescence and the Next Generation. Nature, 554(7693), 458–466.

NYC Children's Cabinet. (2016). *Growing Up NYC: A Policy Framework* (pp. 1–99). City of New York: Office of the Mayor.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Rutter, Michael, & Rutter, M. (1993). Developing Minds: Challenge and Continuity Across the Life Span (pp. 1–416). New York, NY: Basic Books.

Ryan, R. M., & Deci, E. L. (2001). On Happiness and Human Potentials: a Review of Research on Hedonic and Eudaimonic Well-Being. *Annual Review of Psychology*, *52*, 141–166.

Shonkoff, J. P., Richter, L., van der Gaag, J., & Bhutta, Z. A. (2012). An Integrated Scientific Framework for Child Survival and Early Childhood Development. *Pediatrics*, *129*, 1–15.

Spratt, E. G., Friedenberg, S. L., Swenson, C. C., Larosa, A., De Bellis, M. D., Macias, M. M., et al. (2012). The Effects of Early Neglect on Cognitive, Language, and Behavioral Functioning in Childhood. *Psychology (Irvine, Calif.)*, *3*, 175–182.

Sylvestre, A., & Mérette, C. (2010). Language Delay in Severely Neglected Children: a Cumulative or Specific Effect of Risk Factors? *Child Abuse & Neglect*, *34*, 414–428.

Sylvestre, A., Bussières, È.-L., & Bouchard, C. (2016). Language Problems Among Abused and Neglected Children: A Meta-Analytic Review. *Child Maltreatment*, *21*, 47–58.

Todd, P. E., & Wolpin, K. I. (2003). On the Specification and Estimation of the Production Function for Cognitive Achievement. *The Economic Journal*, *113*(485), F3–F33. https://doi.org/10.1111/1468-0297.00097

Todd, P. E., & Wolpin, K. I. (2007). The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps. *Journal of Human Capital*, 1(1), 91–136. https://doi.org/10.1086/526401

Walker, S. P., Wachs, T. D., Black, M. M., Nelson, C. A., Huffman, S. L., Baker-Henningham, H., et al. (2011). Inequality in Early Childhood: Risk and Protective Factors for Early Child Development. *Lancet*, *378*, 1325–1338.

Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data (2nd ed.). Cambridge,

MA: MIT Press.

Wulczyn, F., Barth, R., Yuan, Y.-Y., Harden, B. J., & Landsverk, J. (2005). Beyond Common Sense: Child Welfare, Child Well-being, and the Evidence for Policy Reform. Aldine Transaction.