I Z A Institute
of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11450

Understanding the Mechanisms through Which Adverse Childhood Experiences Affect Lifetime Economic Outcomes

Stefanie Schurer
Kristian Trajkovski

APRIL 2018

I Z A Institute
of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 11450

Understanding the Mechanisms through Which Adverse Childhood Experiences Affect Lifetime Economic Outcomes

Stefanie Schurer
The University of Sydney, IZA and ARC Life Course Centre

Kristian Trajkovski
The University of Sydney

APRIL 2018

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Understanding the Mechanisms through Which Adverse Childhood Experiences Affect Lifetime Economic Outcomes

Over the past two decades, researchers have shown a growing interest in the role of adverse childhood experiences (ACEs) – children's confrontation with maltreatment and household dysfunction – in shaping lifetime opportunities. However, this is the first study to quantify the economic penalties of ACEs and identify the mechanisms which produce the relationship. We source data from the National Child Development Study to construct an ACE index based on prospective childhood information and estimate an earnings penalty of 7.3 percent for each additional ACE, a 53.1 percent higher probability of being welfare dependent, and a 34 percent higher probability of poverty at age 55, controlling for important background factors measured in childhood. The results are driven by parental neglect, a component of the ACE index based on teacher assessments. Observed differences in later-life earnings between children with and without neglect exposure can be fully explained by observable differences in human capital accumulated by age 33. The productivity loss in an economy due to parental failures to nurture and protect their children is likely to be high. Our findings contribute to a wider discussion on the multidimensionality and expanding definitions of childhood poverty.

JEL Classification: I32, J12

Keywords: childhood poverty, adverse childhood experiences, economic outcomes, welfare dependence, human capital

Corresponding author:
Stefanie Schurer
School of Economics
The University of Sydney
Sydney 2006
Australia

E-mail: stefanie.schurer@sydney.edu.au

NON-TECHNICAL SUMMARY

Children raised in material poverty are at a disproportionately higher risk of developmental delays, poorer educational and health outcomes, lifelong under- or unemployment, welfare dependency, and involvement in crime. The resulting economic cost of growing up poor to individuals, families and society is therefore sizable.

However, it is unclear whether it is early-childhood economic hardship per se that causes later-life socio-economic disadvantage, or whether it is the adverse childhood experiences to which children in economically disadvantaged households are disproportionately exposed (e.g. parental abuse and neglect, parental relationship instability, and parental mental health or substance abuse). Using high-quality cohort data from the United Kingdom (National Child Development Study), we examine how adverse childhood experiences between ages 7 and 16 affect individuals' lifetime economic outcomes (as captured by income, welfare dependency and subjective poverty). We also identify the channels through which this link takes place.

Our findings indicate that exposure to adverse childhood experiences is more common amongst children growing up in economically disadvantaged families, who are twice as likely as children in economically better-off families to experience at least one adverse life event. However, adverse childhood experiences affect children's developmental pathways negatively irrespective of parental socio-economic background.

We also find that adverse childhood experiences are strong predictors of economic outcomes at age 55, over and above the influence of other important early-life predictors (e.g. health at birth, parental education and parental occupation). One additional adverse childhood experience is associated with an earnings "penalty" of 7.3 percent, and a significant increase in the probability of welfare dependence and subjective poverty.

The experience of neglect, as assessed by the child's teacher when the child was age 7 to 11, is the driving factor in the association between adverse childhood experiences and economic outcomes. Differences in earnings by age 55 between those who experienced neglect and those who did not are almost entirely explained by differences in human and health capital accumulated by age 33.

Altogether, our findings have important policy implications. Critically, they suggest that large gains in productivity could be attained by targeting household dysfunction as a way to alleviate childhood poverty. Further research into the factors leading to these forms of early life adversity, and the processes that can be put in place to minimise these is needed.

1. INTRODUCTION

Children raised in material poverty are undisputedly at a much higher risk of cognitive and socioemotional developmental delays, poorer educational and health outcomes, lifelong under- or unemployment, welfare dependence, and involvement in crime (Bird 2013, Duncan et al. 2012, Duncan et al. 2010, Wiborg and Hansen 2009, Barajas et al. 2007, Bradley and Crowyn 2002, Duncan et al. 1998). The impact of income poverty is clearly visible in a child's brain surface area (Noble et al. 2015) and gray matter volume (Hanson et al. 2013) as early as age 3, demonstrating that a lack of material resources leaves a permanent mark on a child's cognitive potential. The resulting economic cost of growing up poor is sizable. Estimates of such costs to society range between 1 percent of GDP in the UK (Blanden et al. 2010) and 1 to 4 percent in the United States (Holzer et al. 2007).

A wealth of literature has examined the impact of childhood poverty, defining "poverty" as either a lack of access to financial or educational resources (e.g. Duncan et al. 2012, Cohen et al. 2010, Currie 2008, Case et al. 2001). Official child poverty statistics are exclusively based on predefined income or consumption thresholds (Roosa et al. 2005, Whiteford and Adema 2007, Adamson 2012).[1] Yet, psychologists are increasingly turning their attention to the tangible explanations for the harmful impact that poverty can have on children and their families (Evans and Kim 2010, Evans 2004). Compared with their economically advantaged counterparts, poor children are confronted with more family turmoil, violence, separation from their families, instability, and chaotic households. They experience less social support, and their parents are less responsive, more authoritarian, and less likely to nurture or protect them (Gershoff et al. 2007, Hart and Risley 1995). Evans (2004) suggests that "cumulative rather than singular exposure to a confluence of psychosocial and physical environmental risk factors is a potentially critical aspect of the environment of childhood poverty" (p. 77).

Such cumulative risks are sometimes referred to in the literature as adverse childhood experiences (ACEs) (Felitti et al. 1998, Dube et al. 2003, Anda et al. 2006). Their definitions usually include measures of maltreatment (neglect, abuse) and family dysfunction (parental alcohol or drug abuse; mental health issues; absences due to death, divorce, or incarceration). The contribution of our study to the literature is to explore ACEs as an alternative definition of childhood poverty. We hypothesize that ACEs capture the key risk factors that interfere with a child's lifetime economic

[1] In all OECD countries, a child is considered to be poor if his or her family income lies below 50% of the country's median income. Some argue that absolute- and relative-threshold-based definitions of poverty fall short of adequately capturing the needs of families or the severity of deprivation (UNICEF 2012). Alternative measures are sometimes used in the literature such as the income-to-needs ratio or a proxy for the persistence of poverty (see Barajas et al. 2007 for a discussion).

potential, independent of a child's access to material or educational resources. Although a vast literature (which we will review carefully in Section 2) has emerged that links ACEs with medical outcomes in adulthood, to date there is little empirical evidence on the lifetime economic handicaps of ACEs. There is also no empirical evidence on the channels through which these relationships may emerge. Exploring the lifetime economic impacts of childhood poverty is important from the perspective of the policymaker. Knowledge of the economic disadvantages tied to ACEs can be used to calculate the total cost of childhood trauma – and inform effective policy.

To explore the link between ACEs and lifetime economic opportunities, we use high-quality cohort data from the National Child Development Study (NCDS) (Power and Elliott 2006). The NCDS followed a birth cohort of children born within one week of each other in the United Kingdom from birth in 1958 up until age 55. The study is rich in detailed information about parents and their children – at birth, age 7, age 11, and age 16. Such a wealth of data allows us to construct an objective measure of ACEs based on negative family-related life-event data that was recorded between the age of 7 and 16. Thus, we neither rely on self-reports of trauma nor on retrospective information. Because follow-up data was collected on the children in young adulthood up until age 55, we can link earlier-life ACEs with lifetime economic outcomes – as measured by foregone earnings, welfare dependence, and subjective poverty – and identify the channels through which this connection may emerge. To quantify the importance of each underlying mechanism, we use a variance-decomposition approach that was developed in Heckman and Pinto (2015) and was applied in Heckman et al. (2013). We calculate the contribution of differences in observable characteristics, measured at a time when cohort members enter adulthood, to the observed differences in earnings, welfare dependence, and subjective poverty between cohort members with high doses of ACEs and cohort members without.

Our analysis is centered on the underlying assumption that ACEs affects children's developmental pathways irrespective of parental socioeconomic background. Empirically, we are able to demonstrate that this is indeed the case. Although ACEs are disproportionately more common in economically disadvantaged families – children in such families are twice as likely to experience at least one adverse event – ACEs also occur in more privileged families. This is a critical finding, because privileged children at risk of maltreatment and family dysfunction who come from higher-income families would not be detected as "in need" by public welfare programs which define need solely on the basis of family-income thresholds.

Furthermore, we find that ACEs are strong predictors of economic outcomes at age 55, over and above the influence of standard early-life predictors including health at birth; parental education and occupation; and other background factors. Experiencing one additional ACE – on

a scale that is bound between 0 and 6 – is associated with an earnings penalty of 7.3 percent, and a significant increase in the probability of welfare dependence and subjective poverty. These findings are robust to alternative definitions of ACEs, and allowing for nonlinearities in the relationship between ACEs and economic outcomes. The experience of neglect, an assessment made by the cohort member's teacher between the age of 7 and 11, is the driving mechanism in the association between ACEs and economic outcomes. Digging deeper, the observed differences in net earnings by age 55 between those who experienced neglect and those who did not are almost entirely explained by differences in human capital – educational achievements and cognitive skills – accumulated by age 33.

Our findings lend support to suggestions made elsewhere that "The true measure of child poverty is parenting" (Heckman 2011, p. 4). Good parenting will set the foundation for the creation of personal, social, and – as we show – economic wellbeing (Heckman and Mosso, 2014). The previous literature focuses predominantly on positive parenting behaviors as investment in child development. Our study suggests that negative parenting behaviors, such as child neglect, is clearly a divestment. We cannot answer the question of what causes poor parental behaviors: income poverty maybe a cause of child neglect simply because income-poor parents have little cognitive resources left to deal with every day's challenges (see Cobb-Clark et al., 2016 for theoretical considerations). Traditional public policy responses to alleviate child poverty have come in the form of conditional or unconditional cash transfers. Although cash transfers may be effective in boosting poor children's human capital as a side product (Gaitz and Schurer, 2017; Mullins 2016; Dahl and Lochner, 2012), they are neither designed to nor may they be effective to address poor parenting behaviors. For instance, Gaitz and Schurer (2017) show that an Australian unconditional cash transfer has no impact on parenting styles and activities. If the objective of the policy maker was to reduce children's exposure to poor parenting behaviors as an investment into their human capital, it may be more effective to direct resources to parenting interventions in primary care (see Brockmeyer et al 2016 and references therein) or family-home visiting programs (see Huston 2011 and references therein). Public policy that directly addresses poor parenting may produce large economic productivity gains.

This paper will proceed as follows. In Section 2, we review the existing literature on the association between ACEs and lifetime economic and health outcomes. In Section 3, we explain the data used for the empirical analysis. Section 4 outlines our empirical modeling strategy. In Section 5, we present the estimation results. Section 6 discusses the limitations of our study design and the policy implications of our findings. Supplementary material is provided in the appendix.

2. LITERATURE REVIEW

The origins of the ACE debate

Adverse childhood experiences (ACEs) are defined as "potentially traumatic events that can have negative, lasting effects on health and well-being" (Felitti et al. 1998). There is no single ACE but rather a whole host of possibilities, including child maltreatment, household dysfunction, exposure to mental health or substance abuse problems of a caregiver, and contact of a family member with the criminal justice system. Most of the early work focuses exclusively on the role of child maltreatment, which encompasses physical, sexual, and emotional abuse as well as neglect.

The seminal work by Felitti et al. (1998), also known as the ACE Study, demonstrates a significant relationship between exposure to ACEs (defined by child maltreatment) and risky health behaviors and disease in middle age using a sample of employed adults covered by Kaiser Permanente, a US private health insurer. The study found that individuals who reported four or more categories of childhood maltreatment, compared with those who experienced none, were four to 12 times more likely to suffer from alcoholism, drug abuse, depression, and suicidal thoughts; they were also two to four times more likely to smoke, and up to 1.6 times more likely to be obese.

Brooks (2012) has described these results as "striking" (p.1), as they revolutionized the way in which researchers and health professionals perceive childhood maltreatment. The study showed that ACEs could not only be seen as the root cause of mental and social problems in victims but also the leading cause of adult morbidity in developed nations. The ACE Study has some limitations, however. The authors only control for the confounding effects of age, sex, race, and educational attainment, and fully disregard the impact of childhood socioeconomic status. This is problematic because many studies show a strong association between household poverty and the probability of child maltreatment (Goldberg et al. 2013, Cancian et al. 2010). Similarly, there is a strong link between childhood poverty and health problems in adulthood (Magnuson and Votruba-Drzal 2008). The ACE Study does not disentangle these pathways, which Clark et al. (2010) considers its "major methodological limitation" (p.386).

Palusci (2013) notes that since the original ACE Study, almost 60 papers have followed more or less its methodological approach, corroborating and extending its findings. Dong et al. (2003), Dong et al. (2004), Danese (2009), and Brown et al. (2009) have assessed the impact of ACE – measured by maltreatment factors only – on liver disease, ischemic heart disease, cardiovascular disease, and premature mortality, respectively. Using data from the NCDS and an extended measure of ACE, Kelly et al. (2013a and 2013b) and Solis et al (2015) find significant relationships between high-dose ACEs and cancer, mortality, and general wear and tear, controlling

for a rich set of early-life background factors. Isohookana et al. (2016) and Thomas et al. (2009) find a significant link between early-childhood abuse and obesity and unhealthy weight control behaviors; however, such a finding could not be replicated by Hariharan and Schurer (2017) using NCDS data. Schilling et al. (2007) find a significant relationship between ACE and depressive symptoms, drug use, and antisocial behavior. Investigating a sample of children from New Zealand, Danese (2009) shows that those who were exposed to one or more ACEs were more at risk for depression later in life. Mersky et al. (2013) show a robust association between ACE and heavier use of tobacco, alcohol, and marijuana. More recently, Merrick et al. (2017) demonstrate that the link between childhood adversity and adult mental health service use is driven by a higher risk of depression, suicidal thoughts, drug use, and alcoholism.

The relationship between ACE and skills, education, and crime

Some studies document a link between maltreatment experiences and cognitive and noncognitive skill development. Fletcher and Schurer (2017) use sibling-fixed-effects models on a US cohort to study the causal impact of maltreatment experiences on non-cognitive skill development in young adulthood. The authors find that sexual abuse experiences result in higher levels of neuroticism, while parental neglect results in lower levels of conscientiousness plus higher levels of neuroticism. Richards and Wadsworth (2004) show a long-term detriment of maltreatment on cognitive function; memory and concentration; and educational attainment. Using data from the Christchurch birth cohort study, Boden et al. (2007) convey that study participants who have experienced either sexual or physical abuse are significantly less likely to complete secondary schooling or to enroll at a university.

The impact of maltreatment on educational attainment is likely to operate through suboptimal school performance. Wodarski et al. (1990) report that students who experienced earlier-life abuse and/or neglect score lower on standardized language tests and are twice as likely to repeat a grade. Using data on siblings, Slade and Wissow (2007) find that children with maltreatment experiences score significantly lower grade point averages and have more problems with completing homework assignments in middle and high school. In line with previous evidence, the authors link poor school performance to cognitive deficits related to attention problems that result from maltreatment experiences.

Currie and Tekin (2012) further highlight the potential impact of maltreatment on the propensity to participate in criminal activity. Using siblings- and twin-fixed-effects models, the authors show that experiences of child abuse and neglect double the likelihood of committing a crime in young adulthood. Interestingly, the authors find this relationship for both boys and girls.

The relationship between ACE and economic outcomes

Despite broad empirical evidence that supports a significant link between ACEs and health, education, and skill development, less is known about the impact of ACEs on lifetime economic outcomes. Only recently, a series of studies has emerged that provide some insights. For instance, Metzler et al. (2017) use cross-sectional data from the 2003/2004 Behavioral Risk Factor Surveillance System (BRFSS) from 10 states and the District of Columbia to study the relationship between ACE and employment, and poverty in adulthood. Adults who experienced four or more ACEs in childhood (retrospective reports) were 2.3 times as likely to be unemployed, and 1.6 times as likely to live in a household reporting poverty than adults with no or less ACEs. Sansone et al. (2012) and Covey et al. (2013) find similar impacts on adulthood employment status. Currie and Widom (2010) find a 14 percent gap in employment probabilities at age 40 between adults with and without court-substantiated histories of abuse/neglect, controlling for background characteristics. Where participants reported earnings, individuals with documented histories of abuse and/or neglect reported almost $8,000 less per year on average than controls. Using self-reported and retrospective data from the 2009 BRFSS, Liu et al. (2013) show that men who had experienced one to three ACEs were almost twice as likely to be unemployed than men with no ACEs. The authors suggest that the link between ACEs and unemployment is mediated by education, marital status, and social support. Studying the mediating factors of the relationship between ACE and health outcomes, Font and Maguire-Jack (2016) find that adults who report sexual abuse experiences have significantly lower income levels; the magnitude of the income reduction associated with sexual abuse is not reported. Using data from the NCDS (and other British cohort data), Conti et al. (2017) find no link between child maltreatment – defined by retrospective, self-assessed measures – and employment or earnings.

These previous studies show a link between ACE and adulthood economic outcomes, but they do not provide a good understanding of the magnitude of this impact. With the exception of Currie and Widom (2010), all studies rely on retrospective self-reports of ACEs. We contribute to this very recent literature by (i) providing a rigorous analysis of the later-life economic penalties of ACEs in one major OECD country, (ii) identifying the mechanisms underlying this relationship, and (iii) improving upon previous study designs. Many previous studies were not able to adequately control for childhood socioeconomic status and relied on later-life retrospective self-evaluations of maltreatment and household-dysfunction experiences. We discuss the limitations of retrospective ACE measures in the next section.

Measurement issues

When it comes to testing the relationship between ACEs and outcomes, one obstacle is that childhood adversity is difficult to measure. At the time of occurrence during childhood, it is hard for anyone outside a child's immediate environment to truly know whether a child is confronted with such challenges as familial instability or parental maltreatment. Existing studies have tackled this problem in a variety of ways, revealing that all measures of ACEs present certain benefits and limitations.

Most of the previous studies discussed above use retrospective, self-reported data on parental maltreatment, which poses reliability concerns. Some authors argue that retrospective reports of ACEs are always invalid for two reasons. First, people may forget (or choose to forget) past maltreatment as they grow older. Secondly, individuals with severe health or employment problems may perceive their childhood experiences more negatively than their healthier or more successful peers (Brown and Harris 1978, Clark et al. 2010).

For instance, previous literature confirms the existence of recall bias, wherein the accuracy of self-reported maltreatment is a function of current health status (Widom et al. 2004, Hardt and Rutter 2004). The phenomenon of "effort after meaning" explains such behavior: unhealthy individuals search for an explanation for their state of bad health, thus assigning more meaning to negative past events. If this is true, studies using self-reported data will likely overestimate the effect of ACEs on health outcomes. Widom et al. (2004) conclude that while "it is tempting to be convinced by the volume of retrospective studies which link child abuse to certain outcomes ... the studies may all suffer from the same potential biases" (p. 721).

Conversely, Currie and Tekin (2012) assert that "several researchers have studied the validity of self-reported data on child maltreatment and have concluded that, if collected properly, this data is valid" (p.514). Data validity is improved if respondents can listen to prerecorded questions through earphones and enter their answers directly on laptops to maintain confidentiality and minimize the potential for interviewer influence. To ensure accurate responses about the timing of events, subjects should also be prompted with a calendar of important events. Currie and Tekin (2012), who use cohort data from Add Health, which explicitly followed these protocols, show that older cohort members do not differ in their reports of ACEs than younger cohort members. They also demonstrate that twins who differed in their self-reports of maltreatment did not differ in their self-reports of family information where no difference was expected. Thus, the authors conclude that the maltreated twin did not systematically suffer from recall bias or effort after meaning, reinforcing the validity of the ACE data.

To mitigate concerns about retrospective ACE measures, some studies opt for administrative data such as court-substantiated cases of child abuse, or cases of maltreatment reported to government agencies. For example, Currie and Widom (2010) and Young and Widom (2014) use court-substantiated abuses to estimate the effect of ACEs on economic wellbeing and emotional processing in adulthood. The benefit of court-substantiated data is that it is considered objective. However, Currie and Tekin (2012) argue that such data captures only a small fraction of all ACEs because of severe underreporting and low conviction rates. Official records of abuse are likely to pertain to households that catch the attention of official agencies for other reasons, such as unemployment or ill health. As such, reliance on administrative data is likely to produce a small and unrepresentative sample of families in which ACEs occurs.

In the past decade, more studies have exploited prospective longitudinal data to construct an ACE measure. Prospective longitudinal studies collect information on cohort members at several stages during childhood, during which reports are obtained from family members, doctors, or teachers. This information can be used to construct a more reliable ACE measure, since it captures objective evidence of adversity at the time of its occurrence. Danese et al. (2007), for example, use data from the Dunedin Multidisciplinary Health and Development Study to assess the effect of ACEs on adult inflammation. They construct their ACE measure from a combination of behavioral observations and parental reports during childhood in addition to retrospective reports by study members once they have reached adulthood. The authors manage to avoid using self-reports for all ACE indicators except outright abuse (physical and sexual abuse).

Kelly-Irving et al. (2013a) and Solis et al (2015) are two of the few studies which use an ACE index that does not rely on retrospective reports. Although available in their data,[2] their ACE index does not incorporate physical or sexual abuse. We follow these two studies to construct an ACE index solely from prospective data that does not rely on self-reports and was collected decades before economic outcomes were recorded. Unfortunately, we cannot identify exogenous variation in ACEs to identify the causal impact of ACEs on economic outcomes like Currie and Tekin (2012), Fletcher and Schurer (2017), and Slade and Wissow (2007), who control for family fixed effects by using siblings or twin samples. However, we do carefully control for childhood socioeconomic status (parental education, occupation, and region of residence) and other relevant pre-treatment conditions so our findings can be interpreted as the relationship between ACEs and economic outcomes alone, without the confounding influence of childhood socioeconomic status, family composition, and at-birth health outcomes.

3. NATIONAL CHILD DEVELOPMENT STUDY (NCDS)

[2] Conti et al. (2017), Hariharan and Schurer (2017), and Kelly-Irving et al. (2013a) use self-reported maltreatment indicators that were included in a special module on biomarker assessment.

The analysis is conducted with data from the National Child Development Study (NCDS), a British cohort study that collected information at birth on 18,558 children born within a single week in the United Kingdom (UK) in 1958 (Power and Elliott 2006). This study provides longitudinal data on each child's birth outcomes; physical and educational development into young adulthood; economic outcomes; family situation; employment; health; wellbeing; social status; and behavioral attitudes. The data set includes information from different stages of cohort member lives, collected through interviews with the primary caretaker (predominantly the mother), assessments of the cohort members' ability by the interview team, and teacher assessments. In later sweeps, cohort members were interviewed themselves.

Information on children was collected at ten different points in time: at ages 0, 7, 11, 16, 23, 33, 42, 46, 50 and 55, with age 0 being sweep 0, age 7 being sweep 1 and so on. The earlier collections gathered comprehensive information on both the children's cognitive and noncognitive abilities as well as information on parental background such as: (i) family background and financial situation from birth to age 16; (ii) cohort member physical and mental health outcomes from birth to age 55; (iii) household composition and structure in terms of family composition within household; (iv) education covering information from primary school through secondary and tertiary education (here, we consider school participation and activities as well as later life course qualifications of the children as well as educational information about the mother and father); (v) cognitive and noncognitive skills covering the child's early-life test scores of reading, writing, and mathematics as well as personality trait test scores; and (v) employment and financial situation during adult years from age 17 onwards.

Although 18,585 children and their families participated in the first wave of the data collection, we are able to follow 5,760 cohort members until age 55 with no missing observations on all relevant variables. We will show in a later section the direction and the degree to which our estimation results are likely to be influenced by attrition.

ACE index components

To construct a measure of adverse childhood experiences (ACEs), we use prospective information provided through the earlier survey sweeps and teacher assessments. Following Kelly-Irving et al. (2013a) and Solis et al. (2015), we construct an index of experiences that captures traumatic and stressful events that are out of the child's control and tend to occur and persist over time. This index is constructed from the following items (each item can take a value of 0 or 1):

1. Child in care: child has been either in public or voluntary foster care services at ages 7, 11 or 16.
2. Physical neglect: whether the child appears undernourished or dirty at ages 7 or 11. Information is collected from teacher responses to the Bristol Social Adjustment Guide.
3. Offenders: the child has lived in a household where any given family member (who lives in the same household as the child) was either in prison or on probation at age 11, or a household member was in contact with probation services at age 7 or 11.
4. Parental separation: child has been separated from his or her mother or father due to either death or separation (including divorce) at age 7, 11 or 16.
5. Mental illness: household has been in contact or is still in contact with mental health services at age 7 or 11. Alternatively, any family member has mental illness at age 7, 11 or 16.
6. Alcohol abuse: family member suffers from alcohol problems at age 7.

We sum all items with equal weighting to construct an ACE index, bounding the index between 0 (no adversity) and 6 (for maximum possible adversity). The index is increasing in the frequency of ACEs. In additional analyses, we use a binary measure of ACEs that takes the value 1 if the individuals experienced a high dose of ACEs (ACEs ≥ 2), and 0 otherwise (see Kelly et al. 2013b). In a robustness check, we use each individual component of the ACE index as a measure of adversity.

Outcome variables

The main outcomes of interest are net individual earnings, welfare dependence, and subjective poverty recorded at age 55. Net earnings are measured as net monthly pay in 2011 reported in British pounds. Respondents in the survey were asked about their net monthly income in their main job/occupation after tax and other deductions. As is common in the literature, we take the log of this measure to allow for nonlinearities at the top end of the distribution and to interpret marginal effects of interest in terms of (log) percent changes.

Welfare dependence is based on a question in which respondents are asked "do you or your partner/husband/wife currently receive a regular payment from any of the following sources?" which includes government transfers, tax credits, and benefits as possible answers. Those who do receive any combination of government transfers, benefits, or tax credits would be

classified as welfare dependent and those who do not receive any of these benefits would be classified as not welfare dependent.[3]

A measure of subjective poverty experiences is constructed from a question that asks participants at age 55 whether they consider themselves financially struggling. Respondents are also asked "how well would you say you personally are managing financially these days?" Those who respond as finding it quite difficult or very difficult are classified as living in subjective poverty, while those who respond that they are getting by or able to get by comfortably are classified as not living in subjective poverty. This measure is used instead of a more objective measure of poverty that requires information on the income of all household members, which is not available in the NCDS.

Control variables

To rule out confounding variables, we control for various other factors that could have occurred before the exposure to ACEs and which are out of the cohort member's control. These variables include sex, whether the child was born premature (less than 37 weeks of gestation), or with low birth weight (less than 2500 grams).[4] Similarly, we control for the age of the mother when she gave birth to the child (whether a teenager, young adult mother, or mature aged mother) as well as the number of siblings in the family and birth order, since these factors are likely to have an impact on availability of parental resources to invest in the cohort member's development.[5] We also pay careful attention to controlling adequately for childhood socioeconomic status of the family. To measure parental attitudes toward education, access to education-relevant information, and parenting skills, we use parental education level as measured by the age at which the father and the mother left full-time education. Finally, to capture parental income potential, we control for the father's occupation (if the father is present) and the geographic location in which the family resides.

[3] It should be noted that in 2013, around the same time when the cohort members were interviewed at age 55, welfare reforms occurred in the UK. This reform came into effect beginning 1st April 2013 to replace the Disability Allowance Program with the Personal Independence Program (PIP). Similarly, limits were imposed on the total amount of benefits that a 16-64 year old could claim (Department for Work and Pensions 2015). We believe that this policy change will not have a major impact on our welfare dependence findings as the data questionnaire was conducted for Sweep 9 of the NCDS between September 2013 and March 2014. This is during a time period after the welfare eligibility changes have fully come into effect (to ensure no crossover between the old and new system) whereby each cohort member is exposed to the same type of welfare regime.

[4] Controlling for early life health is important as such factors are associated with poor labour market outcomes. For instance, Johnson and Schoeni (2011) show that low birth weight reduces labor force participation probabilities by 5 percentage points and labor market earnings by roughly 15 percent.

[5] Black et al. (2005) highlight that family size and birth order are both negatively correlated with educational outcomes, as well as earnings and employment, particularly for women.

4. EMPIRICAL FRAMEWORK

Estimating the relationship between ACE and economic outcomes

First, we estimate a linear regression model to test for a statistical relationship between ACEs and later-life economic outcomes. The dependent variable is either log net earnings, welfare dependence, or living in poverty, which are all measured at age 55, and the main independent variable is ACE.

$$Y_i = \beta_0 + \beta_1 ACE_i + \varepsilon_i, \qquad (1)$$

ACE_i is a continuous measure of the number of adverse experiences a cohort member endured during childhood (between age 7 and 16). We also consider a binary measure of ACE_i^B that takes the value 1 if the individual experienced two or more ACEs, and 0 otherwise – where 1 indicates high-dose ACEs (see Kelly-Irving et al. 2013a, Kelly-Irving et al. 2013b). Of particular interest is the parameter β_1. In the case of a continuous ACE measure, β_1 captures the association of one additional adverse event with economic outcomes whereas with a binary measure of ACEs, this coefficient represents the differences in economic outcomes between those with zero or one ACEs, and high-dose ACEs.

It is important to emphasize that the ACE index is an endogenous variable; some children are more likely to suffer from ACEs than others and thus have poor lifetime economic outcomes independent of ACEs. For instance, this could occur because children with ACEs are more likely to be living in low-income or education-poor families, and childhood poverty (in terms of income) is associated with negative economic opportunities later in life (see Fletcher and Schurer 2017 for a discussion). Not controlling for this selection bias would likely overstate the estimated relationship of interest. Therefore, we estimate subsequent models that include controls for X_i to capture the confounding factors mentioned previously.

$$Y_i = \propto_0 + \propto_1 ACE_i + \propto_2 X_i + \varepsilon_i. \qquad (2)$$

We identify $\propto_1$ on the assumption of conditional independence between the error term ε_i and ACE_i. A statistically significant parameter $\propto_1$ is interpreted as a robust association between ACEs and lifetime economic outcomes Y_i, over and above the influence of X_i.

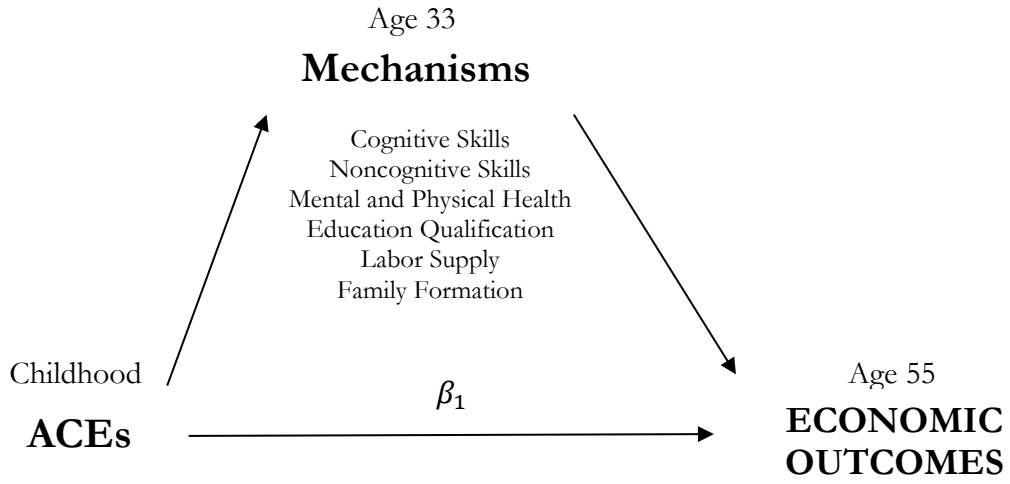
To better understand what components of ACEs drive the relationship, we further explore the association between each individual ACE factor and economic outcomes. We highlight the

important role of child neglect, a key measure of child maltreatment that is relatively easy to observe (here through teacher assessments). In a robustness check, we further explore an ACE measure which excludes parental separation as a possible category of negative experience since the literature on parental separation has produced mixed results on whether it is associated with positive or negative economic or educational outcomes in affected children (Amato 1988, Amato 2000). This alternative ACE index varies between 0 (no adversity) and 5 (maximum adversity).

Decomposition analysis

In a second step, we explore the underlying mechanisms through which ACEs are likely to impact later-life economic outcomes. To identify the likely channels, we use the same decomposition method proposed in Heckman and Pinto (2015) and applied in Heckman et al. (2013). This method decomposes the "treatment effect" of high-dose ACE into observable and unobservable components that explain the difference in outcomes between treatment and control groups. In a robustness check, we conduct the decomposition analysis using child neglect as a treatment indicator. Figure 1 illustrates the possible channels through which ACEs may affect lifetime economic outcomes.

Figure 1: Channels through which ACEs may affect lifetime economic outcomes



The starting point of the mediation analysis is the following equation of economic outcomes:

$$Y_d = k_d + \propto_d \theta_d + B_d X + \varepsilon_d, \qquad (3)$$

where Y_d is the outcome of interest. Let Y_1 and Y_0 be the counterfactual outcomes when ACE equals 1 (high dose) and ACE equals 0 (no ACE or mild dose), respectively. The subscript *d* can take the value 0 or 1 to indicate whether the variable is "fixed" at treatment to flag people – at any given time – who had experienced ACEs compared with those who had not experienced ACEs.[6] k_d is an intercept, and θ_d captures all variables that are likely to mediate the relationship between ACEs and later-life economic outcomes as described in Figure 1. We assume that there are specific young-adulthood outcomes θ_d that are influenced by ACEs and that produce the treatment effect. Therefore, the equation $\theta_d = D\theta_1 + (1-D)\theta_0$ represents the counterfactual outcomes in young adulthood between the treatment and control group. *X* contains all variables that are not affected by ACEs because they occur before exposure. We assume that the outcomes are independent across participants conditional on observed characteristics *X*. ε_d is a zero-mean error term assumed to be independent of both *X* and θ_d.

Although the NCDS collected a vast array of young adult measures, we may not be able to capture all relevant outcomes in young adulthood that are affected by ACEs. These outcomes are summarized as unobservable characteristics. We therefore classify the potential mediating factors captured in θ_d into observable characteristics and unobservable characteristics as follows:

$$Y_d = k_d + \underbrace{\sum_{j\epsilon J_p} \propto_d^j \theta_d^j}_{\text{Observed}} + \underbrace{\sum_{j\epsilon J\setminus J_p} \propto_d^j \theta_d^j}_{\text{Not observed}} + \beta_d X + \tilde{\epsilon_d}\,, \tag{4}$$

$$Y_d = \tau_d + \sum_{j\epsilon J_p} \propto_d^j \theta_d^j + \beta_d X + \tilde{\epsilon_d}\,, \tag{5}$$

where $\tau_d = k_d + \sum_{j\epsilon J\setminus J_p} \propto_d^j \theta_d^j$ and $j \in J_p$ denotes a given mediating factor *j* within a set of factors J_P; $\sum_{j\epsilon J_p} \propto_d^j \theta_d^j$ are all factors for which we have measurements, and $\sum_{j\epsilon J\setminus J_p} \propto_d^j \theta_d^j$ are all mediating factors for which we do not have measurements. Under the assumption that ACE "treatment" affects young-adulthood outcomes but not the impact of such outcomes on later-life outcomes and the impact of the pretreatment variables *X*, we can further simplify this equation by dropping *X* out.

With this simplification, the treatment effect can be decomposed as follows:

$$E(Y_1 - Y_0) = (\tau_1 - \tau_0) + \sum_{j\epsilon J_p} \propto_d^j E(\theta_1^j - \theta_0^j), \tag{6}$$

[6] Here, fixing refers to manipulating treatment status by keeping everything else constant.

We can interpret observed differences in later-life outcomes between the treatment and control group in terms of differences in mediating factors $\mathrm{E}(\theta_1^j - \theta_0^j)$ and differences in unobservable factors $(\tau_1 - \tau_0)$, as captured by differences in the intercept. This method is a variation of a standard Blinder-Oaxaca decomposition analysis (Fortin, Lemieux and Firpo 2011).

Although uncertainty remains about which channels are the most likely ones through which a relationship between ACEs and later-life economic outcomes emerge, we focus on a standard set of intermediary factors (Fletcher and Schurer 2017): cognitive and noncognitive skill development, health, education, labor supply, and marital and fertility decisions. Where possible, we measure these factors in early adulthood (at age 33). The factors are described below.

1. Cognitive skills: ACE may impair cognitive development and thus intelligence. We use mathematics and reading test scores at age 16 as a proxy for cognitive ability, the last measurement available after childhood.
2. Noncognitive skills: ACE may impair socioemotional abilities. We analyze these abilities by looking at internal locus of control tendencies (self-efficacy) at age 33.
3. Health outcomes: ACE may impact health trajectories through problems with psychological developmental and immune health. As a proxy for health outcomes at age 33, we use a self-assessed measure that reports physical health problems and the Rutter Malaise Inventory for mental health.
4. Education outcomes: ACE may directly impact educational attainment, because children may not be able to focus on school and fall behind. We use completed education levels as a proxy for educational attainment at age 33.
5. Family composition: ACE may impact the decision to form a family. Maltreatment experiences are characterized by a breakdown in trust between a caregiver and a child. Thus, a victim of maltreatment may struggle to build trusting relationships in adulthood. We proxy family factors with marital status and the number of children at age 33.
6. Employment status: ACE may impact early-adulthood labor supply. We proxy labor-supply decisions with part- or full-time employment measured by working hours at age 33.

All remaining channels are captured by τ_d, and are thus considered unobservable factors.

5. ESTIMATION RESULTS

Descriptive analysis

Before discussing our estimation results, we present summary statistics (mean, standard deviation, and minimum and maximum values) of key variables used in the analysis. Table 1 provides an overview of the three economic outcome measures recorded at age 55 – net monthly earnings (logarithmized), the receipt of welfare payments, and responses about it being (very) hard to get by with financial resources – all ACE components, and all control variables.[7]

The average net monthly income in the sample is the log of 7.12, which translates into a net monthly earnings of 1,236 pounds or 14,832 pounds per year. Around 10 percent of the cohort members are classified as living in subjective poverty, and 17 percent are dependent on welfare payments. The average ACE is roughly 0.4, which implies that two out of five Brits born in 1958 experience at least one ACE. The maximum number of adverse events that a cohort member experienced is five. Of the full sample, 5 percent experienced at least two adverse experiences. Excluding separation as an ACE component, only 2 percent of cohort members experienced at least two ACEs, suggesting that the most common ACE is separation from parents. In fact, 25 percent of the cohort members experienced separation from their parents until age 16. In stark contrast, only 4 percent of cohort members experienced neglect (assessed by teachers) by age 11.

An important question is whether ACEs are just an alternative proxy for socioeconomic disadvantage. Figure 2a indeed demonstrates the existence of a socioeconomic gradient in ACE but emphasizes that cohort members from more privileged backgrounds also endure ACEs. The figure depicts the bivariate correlation – estimated non-parametrically – between the number of ACEs (vertical axis) and parental education (horizontal axis) for both fathers (dark gray dot-dashed line) and mothers (light gray dashed line). The vertical red lines depict the average age at which parents leave full-time education (around age 15), and the vertical dashed line depicts the average number of ACEs in the sample (0.40). The graph shows that cohort members whose mothers leave full-time education between the age of 12 and 14 weather more ACEs than the sample average (around 0.5), while cohort members whose mothers leave full-time education with a university degree (>20 years) encounter around 0.2 ACEs. This means that one in two children from low-SES backgrounds withstand at least one ACE, while only one in five children from higher-SES backgrounds do so. A similar gradient is observed for paternal education levels.

[7] The sample sizes vary for the different outcome measures. There are 5,760 individuals with non-missing information on the ACE index. Yet, there are only 3,784 individuals with positive monthly net salary, and 5,627 and 5,694 individuals with non-missing information on subjective poverty (self-assessments) and welfare dependence, respectively. The final estimation sample with non-missing information for the above three outcomes is 2,793, 5,084, and 5,042 individuals, respectively.

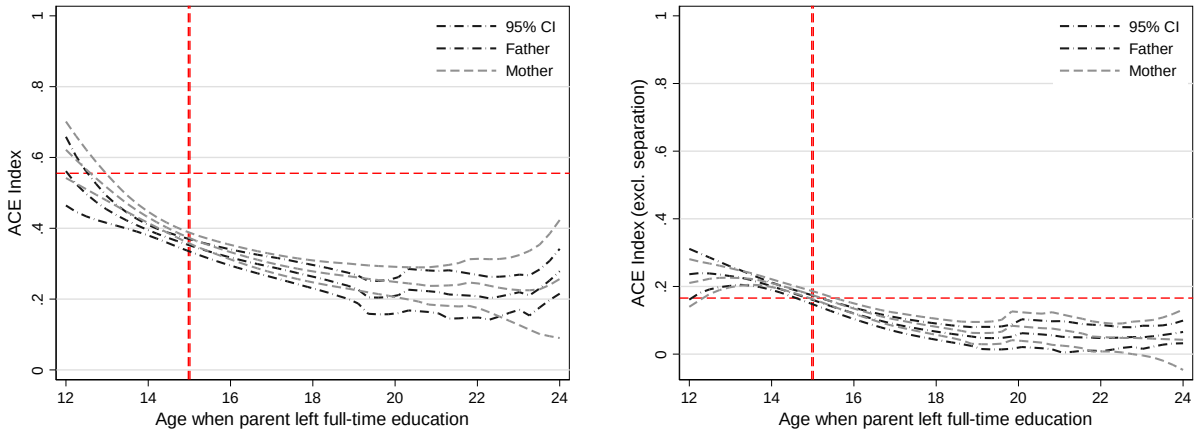
Table 1: Summary statistics

	Mean	Std. Dev.	Min	Max	N
Economic outcomes age 55					
Log net earnings, age 55	7.12	0.89	0	10	3784
Subjective poverty, age 55	0.10	0.30	0	1	5627
Welfare dependence, age 55	0.17	0.38	0	1	5694
Pre-treatment control variables					
Female	0.54	0.50	0	1	5760
Low birthweight	0.07	0.26	0	1	5760
Premature birth	0.02	0.15	0	1	5005
Number siblings, age 7	3.71	0.96	2	5	5095
Mother age when child born	2.08	0.41	1	3	5487
Father SES	4.75	1.64	1	8	5074
Father age when left FT education	15.13	2.10	12	24	4228
Mother age when left FT education	15.06	1.67	12	24	4347
Geographic location	5.86	3.07	1	11	5492
Cognitive skills, age 7	61.98	12.69	17	98	4987
Non-cognitive skills, age 7	7.36	8.01	0	59	5163
Mechanisms – young adulthood outcomes					
Cognitive math score, age16	14.19	7.00	0	31	4487
Cognitive reading score, age16	26.97	6.09	1	35	4501
Non-cognitive skills, age 33	2.48	0.90	0	3	5760
Physical health, age 33	0.40	0.49	0	1	5760
Malaise inventory, age 33	2.29	2.86	0	22	5760
Self-assessed health, age 33	0.03	0.16	0	1	5760
Chronic health problem, age 33	0.28	0.45	0	1	5760
Overall health, age 33	1.37	1.04	0	4	5760
Education outcome, age 33	2.65	1.48	0	5	5658
Number children, age 33	1.44	1.10	0	8	5287
Marriage status, age 33	0.92	0.36	0	2	4078
Employment: part-time, age 33	0.28	0.45	0	1	5760
Employment: full-time, age 33	0.13	0.34	0	1	5760
Adverse Child Experiences (ACE)					
ACE dummy	0.05	0.22	0	1	5760
ACE index	0.38	0.62	0	5	5760
Robust ACE dummy (excl. separation)	0.02	0.13	0	1	5760
Robust ACE index (excl. separation)	0.12	0.40	0	4	5760
Child in care, age 7-16	0.03	0.17	0	1	5748
Child neglected, age 7-11 (teacher ass.)	0.04	0.20	0	1	5183
Separation from parents, age 7-16	0.25	0.43	0	1	5745
Mental illness in family, age 7-16	0.03	0.18	0	1	5570
Alcohol abuse in family, age 7	0.01	0.08	0	1	4880
Offender in family, age 7-11 (0,1)	0.02	0.13	0	1	5570

Note: Descriptive statistics are based on NCDS information collected at different sweeps throughout the lives of birth cohort members.

Because separation from parents is such an important contributor to overall ACE, Figure 2b shows the bivariate relationship between ACEs and parental education levels when the separation component is omitted from the ACE index. We demonstrate that the education gradient in ACE remains the same, though less extreme, when removing this component.

Figure 2: Relationship between parental education and ACE score



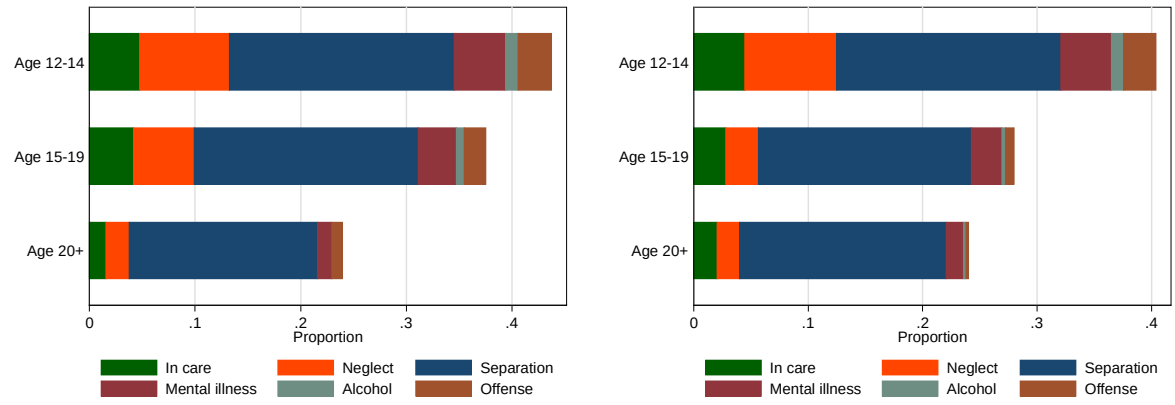
a) Full ACE score

b) ACE score excluding separation

Figures 3a (Mother) and 3b (Father) break down the education gradient in ACE by the individual components that contribute to the ACE score. For clarity, we show the prevalence of each ACE component within three groups of parental education: those who leave school at age 20+ (university degree); between age 15 and 19; and at age 14 or younger. Independent of whether we measure disadvantage by maternal or paternal education level, parental separation is the main contributor to ACE in each education category, making up 75 percent of total ACEs for the least disadvantaged cohort members, and 45 percent for the most disadvantaged cohort members.

Neglect occurs regardless of one's socioeconomic status, however it is over-represented in the most disadvantaged group (where neglect comprises 22 percent of total ACEs compared with 16 percent for the somewhat-advantaged middle group and 10 percent for the most well-off group). Alcohol problems and criminal offences contribute least to ACE, which may be due to systematic under-reporting in the survey.

Figure 3: Relationship between parental education (age when left full-time education) and individual ACE index components



a) Mother

b) Father

Systematic attrition

An important limitation of our analysis is that 65 percent of cohort members (around 12,000 of the original birth cohort observed in sweep 1) drop out of the NCDS at some point, and thus we do not observe their age-55 outcomes. However, we observe for 9,645 cohort members, who drop out, their earlier-life ACEs. The attrition in our sample is not important if it occurs at random. However, systematic attrition is more likely here, meaning that the existence of ACEs relates to the probability of a subject dropping out of the sample. Systematic attrition could lead to either an upward or downward bias in our estimated regression coefficients. Therefore, to test whether systematic attrition is an issue, we investigate the differences in means of ACE components between our estimation sample and the cohort members who drop out after age 16 and present.

Table 2 reveals that the dropout sample is nearly twice as likely to experience high-dose ACE than the final estimation sample. More specifically, cohort members in the final estimation sample have a 5 percent probability of having high-dose ACE in childhood versus 9 percent of cohort members in the dropout sample – a statistically significant difference of four percentage points. The disparity for neglect is 4 versus 8 percent, respectively; and for separation, 25 versus 51 percent. Additionally, children in the dropout sample are twice as likely to come from a household in the lowest socioeconomic class.

If the dropout sample is also more likely to respond negatively to ACEs in the future – which is reasonable to assume given the heavier exposure – then we are likely to underestimate the relationship between ACEs and later-life economic outcomes. Under this assumption, we conclude that selective attrition, at its worst, would lead to a downward bias of our estimates.

Table 2: Comparisons of means between final estimation sample and dropout sample

	Final		Dropout		Difference
Childhood Adversity	N	Mean	N	Mean	p-value[1]
ACE dummy	5760	0.05	9645	0.09	0.000***
ACE index	5760	0.38	9645	0.7	0.000***
ACE dummy (excl. separation)	5760	0.02	9645	0.03	0.000***
ACE index (excl. separation)	5760	0.12	9645	0.2	0.000***
Child in care, age 7-16	5748	0.03	9554	0.05	0.000***
Child neglect, age 7-11[2]	5183	0.04	8835	0.08	0.000***
Separation from parents, age 7-16	5745	0.25	9615	0.51	0.000***
Mental illness in family, age 7-16	5570	0.03	9320	0.04	0.000***
Alcohol abuse in family, age 7	4880	0.01	8177	0.01	0.004**
Offender in family, age 7-11	5570	0.02	9306	0.03	0.000***
Low socioeconomic status	5048	0.56	9662	0.76	0.000***

[1] p-value refers to t-test statistics on a test for equality of means between estimation and dropout sample.
[2] Child neglect is based on a teacher assessment referring to appearance. *p<0.01, **p<0.05, ***p<0.01.

Estimating the economic burden of ACE

In this section, we present the estimation results of the relationship between ACE and economic outcomes measured at age 55. Table 3 presents bivariate and multivariate estimation results, wherein columns 1, 3, and 5 report bivariate coefficients (no controls, Eq. (1)), and columns 2, 4, and 6 report multivariate coefficients (full set of pre-treatment control variables, Eq. (2)). Each row represents a separate regression model with different dependent variables that measure ACE. Model 1 reports the coefficient of interest for the continuous ACE measure as a dependent variable (bound between 0 and 5). Model 2 uses a binary index that indicates whether the individual experienced high-dose ACE. Models 3 to 8 use each component of the ACE index as dependent variables. Models 9 and 10 present a robustness check to Models 1 and 2 by excluding separation from the ACE index. Table A1 in the appendix shows the full regression results, including a demonstration of coefficient sensitivity to adding each block of pre-treatment control variables individually. Significance levels are considered relevant for p-values smaller than 0.10.

We find a statistically significant association between ACEs and all economic outcomes, independent of whether we control for confounding variables or not. A one-unit increase in ACE is associated with a 10.6 percent reduction in (log) net earnings at age 55 (column 1). Once controlling for the full set of pre-treatment variables, this disparity falls to 7.3 percent, which is still statistically significant at the 5 percent level. Not surprisingly, the estimated earnings penalty is most sensitive to the inclusion of a father's occupational class. The earnings loss increases to almost

20 percent when considering high-dose ACE (Model 2). This relationship is robust even when excluding separation from the ACE index (Models 9 and 10). The key contributor to the negative relationship between earnings and ACE, in terms of magnitude and statistical significance, is the experience of neglect as reported by teachers (Model 4). The multivariate correlation coefficient indicates an earnings reduction of 23 percent (significant at the 5 percent level) due to neglect.

Table 3: Relationship between ACE and economic outcomes at age 55.

	Log net earnings		Welfare dependence (0, 1)		Subjective poverty (0, 1)	
# Model	Raw	Controls	Raw	Controls	Raw	Controls
1. ACE index	-.106***	-.073**	.055***	.051***	.039***	.034***
(0-6)	(.031)	(.032)	(.009)	(.010)	(.007)	(.008)
2. ACE > 1	-.275***	-.192**	.121***	.106***	.046**	.032
(0,1)	(.090)	(.088)	(.027)	(.028)	(.021)	(.021)
By ACE items						
3. In care	-.213*	-.140	.109***	.098***	.042	.031
(0,1)	(.114)	(.110)	(.035)	(.035)	(.027)	(.027)
4. Neglect	-.228**	-.225**	.140***	.132***	.060***	.053***
(0,1)	(.093)	(.092)	(.025)	(.026)	(.020)	(.020)
5. Separation	-.094*	-.068	.048***	.045***	.037***	.027**
(0,1)	(.050)	(.051)	(.015)	(.016)	(.012)	(.013)
6. Mental illness	-.107	-.033	.064**	.051*	.080***	.080***
(0,1)	(.100)	(.097)	(.030)	(.030)	(.023)	(.023)
7. Alcohol abuse	-.247	-.087	.053	.045	.046	.029
(0,1)	(.244)	(.239)	(.078)	(.079)	(.061)	(.062)
8. Offender	-.247*	-.067	.106**	.082*	.134***	.119***
(0,1)	(.143)	(.140)	(.042)	(.043)	(.033)	(.034)
Robustness						
9. ACE index (0-5)	-.145***	-.092**	.074***	.066***	.050***	.047***
(excl. separation)	(.045)	(.045)	(.013)	(.014)	(.010)	(.011)
10. ACE > 1	-.301**	-.181	.167***	.144***	.063**	.052
(excl. separation)	(.145)	(.142)	(.041)	(.041)	(.032)	(.032)
Mean Outcome	7.124		0.165		.091	
Observations	2,793		5,084		5,042	

Note: Dependent variables are: Columns (1) and (2) log of net monthly salary for individuals with positive earnings and less or equal to 20,000 pounds per month (dropped: 209 observations). Columns (3) and (4) = 1 if an individual receives any government transfers including other forms of income, benefits, or tax credits, and 0 otherwise. Columns (5) and (6): = 1 if individuals are currently finding it quite or very difficult to manage financially, and 0 otherwise: comfortably, living alright, or just getting by). Columns (2), (4), and (6) include a full set of early childhood control variables: female, low birth weight, premature birth, mother's age at birth, number of siblings, father's social class, father's age when he leaves full-time education, mother's age when she leaves full-time education, geographic location when cohort member is born. Full estimation results are reported in Tables A1-A5 in the appendix. Standard errors are reported in parentheses. Significance levels: *** 0.01 ** 0.05 * 0.10.

Similarly, ACE is also positively associated with both welfare dependence and subjective poverty. A one-unit increase in ACE is associated with a 5.1 percentage point increase in the likelihood of being welfare dependent, ruling out the influence of pre-treatment control variables. Relative to the base probability of 16.5 percent, this implies an increase in the probability of over 30 percent. This probability increase is again substantially larger for cohort members with high-dose ACE (10.6 percentage points, or 64 percent higher than the base probability). When excluding

separation from the ACE index, the probability increases for welfare dependence are 6.6 and 14.4 percentage points, respectively. Consistent with our findings for earnings, the experience of neglect is the key contributor to the significant relationship between ACE and welfare dependence, dwarfing the impact of any other ACE component (13.2 percentage points, significant at the 1 percent level).

Although we find a statistically significant relationship between ACE and subjective poverty, the association is weaker and less robust than for the more objective measures of earnings and welfare dependence. A one-unit increase in ACE is associated with a 3.4 percentage point increase in the probability of subjective poverty, which implies a 37 percent increase from the base probability. High-dose ACE is not significantly associated with subjective poverty. The key contributing factors to the relationship between ACE and subjective poverty (each significant at the 1 percent level) are the following, in order of magnitude: family member offense (12 percentage points, significant at 1 percent level); family member with mental illness (8 percentage points), and neglect (5 percentage points).

Channels through which ACE may affect lifetime economic outcomes

So far, we have shown that ACE is strongly associated with earnings and increased welfare dependence as well as subjective material poverty. We have furthermore demonstrated that neglect experiences – as assessed by the cohort member's teacher – is the key contributing factor to the significant association between ACE and earnings as well as welfare dependence. In contrast, the key factors driving the relationship between ACE and subjective poverty are whether the cohort member grew up with a family member in contact with criminal justice or mental health services (although neglect is the third strongest contributor).

In what follows, we identify the channels through which early-life adverse experiences impact later-life economic outcomes. To do so, we decompose the raw outcome differences observed between cohort members with and without ACEs into differences due to observable characteristics measured in mid-life – including human and health capital, and family formation decisions – and differences in unobservable characteristics (see Eq. (6)). To distinguish between a "treatment" and "control" group, we use the binary measure of high-dose ACE. Treatment is defined as having two or more ACEs, and that is compared against zero or one ACE.[8]

Because of missing observations, we can only conduct this analysis using a reduced estimation sample for each age-55 outcome measure. The resulting samples are for earnings (N=2,375),

[8] We emphasize that we use the terms treatment and control group not to imply random variation in assignment but to distinguish between two groups that can be compared.

welfare dependence (N=4,211), and subjective poverty (N=4,175). In this smaller sample, the raw differences between the treatment and control group are more pronounced. For instance, the raw difference in net earnings is 26.7 percent, that of welfare dependence is 5.5 percent, and the disparity in subjective poverty is 8.1 percent.

We decompose these observed raw differences into the relative contribution of the following observable characteristics as witnessed in young adulthood (age 33), if available: (i) cognitive skills, as measured by math and reading test scores (only available at age 16); (ii) noncognitive skills using locus of control as a proxy (age 33); (iii) mental health problems assessed via the Malaise Inventory (age 33); (iv) physical health problems (age 33); (v) highest level of completed education (age 33); (vi) whether married (age 33); (vii) number of children (age 33); and (viii) employment status (age 33). All other remaining differences are thought to be attributed to unobserved characteristics.

Figure 4 summarizes the decomposition analysis (full estimation results including significance levels are presented in the appendix, Table A6) for all components. To reduce the dimensionality of results, we bundle math and reading test scores in the cognitive skill category; marital status and number of children in the family category; and different hours worked per week in the employment category (not employed: zero working hours per week; part-time employed: less than 35 working hours per week; full-time employed: 35-50 working hours per week; and employed with extreme working hours: >50 hours per week). We will discuss statistically significant contributions for p-values smaller than 0.10.

The first thing to note is that observable characteristics in young adulthood explain almost three quarters of the observed earnings differences at age 55 between cohort members with and without high-dose ACE. Only 22 percent of the earnings gap is due to unobserved characteristics. The biggest contributor to observed earnings differences are educational outcomes by age 33, which explain almost 30 percent of the earnings gap (significant at the 1 percent level). The second and third largest contributors are cognitive skills measured at age 16 (at 15 percent, significant at the 5 percent level) and physical and mental health at age 33 (12 percent, significant at the 10 percent level). Employment contributes 10 percent to the earnings difference (significant at the 10 percent level).

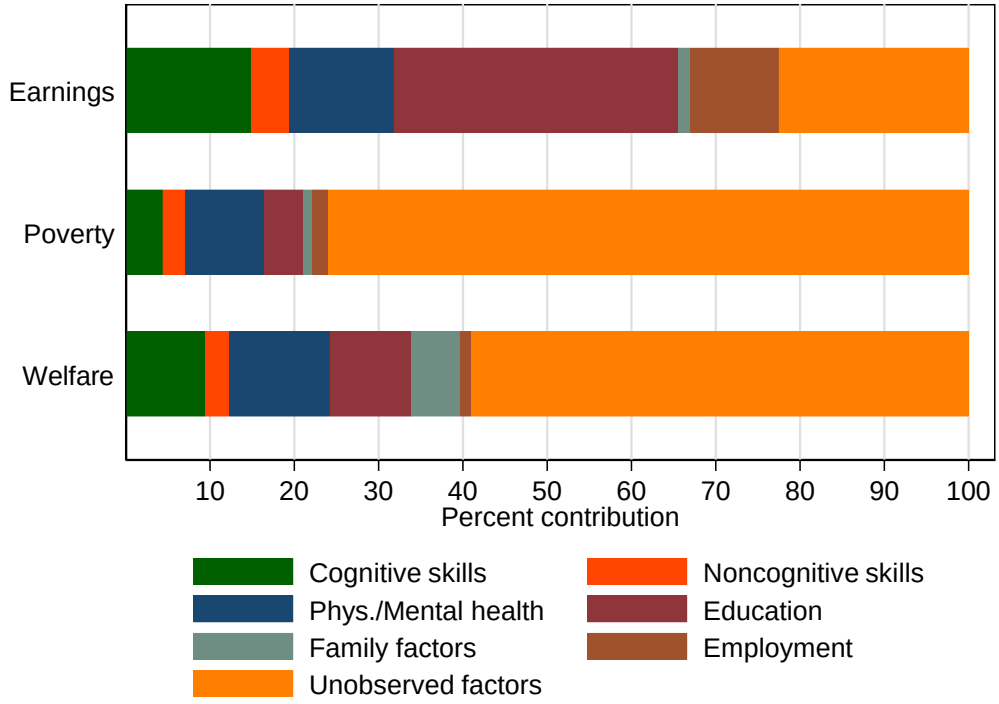
In stark contrast, the variation in welfare dependence and subjective poverty associated with ACEs can hardly be explained by differences in observable characteristics by age 33. Differences in unobservable factors explain approximately 60 percent of the welfare dependence gap and 75 percent of the subjective poverty gap. In terms of what is observable, differences in mental and physical health combined at age 33 make up the largest proportion of the overall difference in welfare dependence (almost 10 percent, significant at the 10 percent level), followed

by differences in cognitive skills (5 percent, significant at the 5 percent level). Differences in health outcomes are the only significant contributor to the treatment effect of high-dose ACE on subjective poverty (almost 10 percent, significant at the 5 percent level).

One hypothesis for why the relationships between high-dose ACEs and welfare dependence and subjective poverty are not as well linked to observable characteristics in young adulthood is that there may be measurement error or misclassification in these variables. This is particularly true for subjective poverty experiences, since that is measured solely based on individual perceptions and rankings of their own financial wellbeing, which we collapsed into a binary indicator of subjective poverty. Cohort members may have different reference points and thresholds as to what they consider problematic.[9]

[9] Misclassification due to different reference points is a problem inherent to all measures that are based on Likert-scale responses, for instance life satisfaction data or personality assessments (Chang 1994).

Figure 4. Decomposition of the treatment effect of high-dose ACE (0, 1) on age-55 economic outcomes by contributing factors measured at age 33.

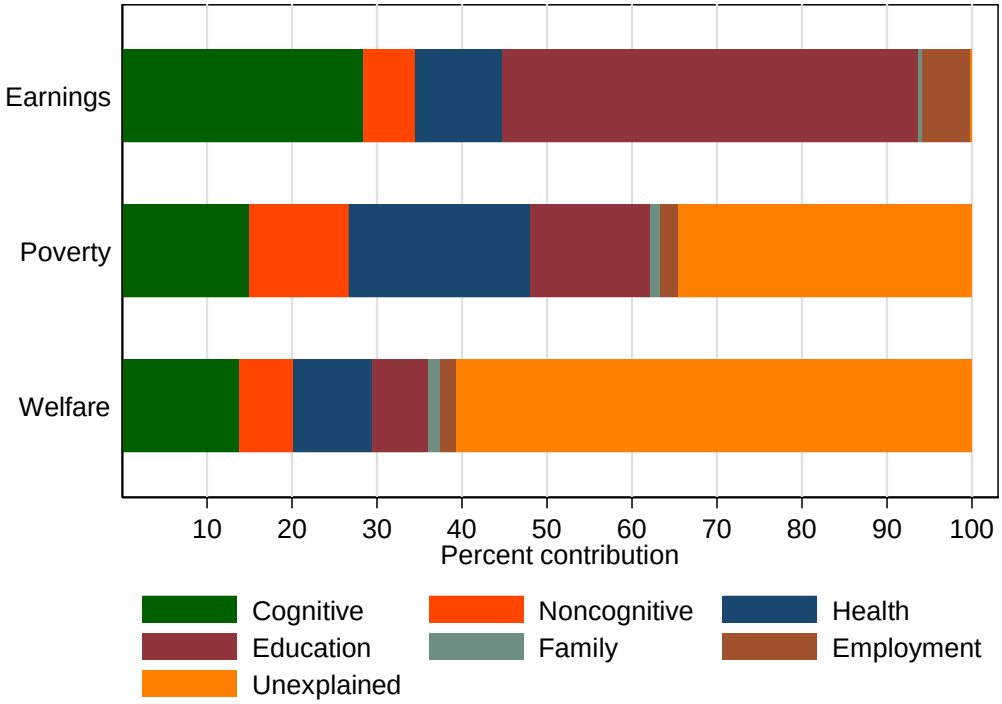


Note: Each bar represents the decomposition of the treatment effect of ACE on a specific economic outcome recorded at age 55 (earnings, poverty, welfare dependence) into the impact of ACE on young adulthood outcomes (cognitive skills, noncognitve skills, phys./mental health, education, family factors, employment) and unobservable factors. Each bar stacks the scaled, absolute percent contribution of age 33 outcomes (age 16 for cognitive skills) to the treatment effect of ACE. Earnings are log of net monthly earnings. Welfare dependence is a dummy variable that takes the value 1 if an individual is welfare dependent, and 0 otherwise. Poverty is a dummy variable that takes the value 1 if an individual reports that it is hard to get by financially, and 0 otherwise. High-dose ACE is a dummy variable that takes the value 1 if cohort member experienced two or more adverse events in childhood by age 16. The predicted difference in outcomes between treatment and control groups are, respectively: Earnings: 26.7 percent, Welfare dependence 5.5 percent; and Subjective poverty: 8.1 percent. The estimation sample sizes are, respectively: Earnings N=2,375, Welfare: N=4,211, Subjective poverty: N=4,175. Full estimation results are presented in Table A6 in the appendix.

Given the important role of neglect – as assessed by a child's teacher – in the link between ACEs and later-life economic outcomes, we repeat the decomposition analysis using neglect as the "treatment" indicator (see Figure 5, full estimation results are reported in the appendix, Table A7). In this smaller estimation sample (N=2,146 for earnings, N=3,782 for welfare dependence, and N=3,746 for subjective poverty), the difference in raw earnings between those who were flagged by their teacher as neglected and those who were not is around 20 percent. Strikingly, almost 100 percent of the earnings penalty due to neglect is explained by differences in human capital attainment by age 33. Differences in cognitive skills at age 16 explain almost 30 percent of the

earnings penalty, while differences in educational attainment by age 33 explain almost 50 percent (both significant at the 1 percent level). Again, differences in welfare dependence and subjective poverty are less well explained by differences in observable characteristics (40 percent and 65 percent, respectively). Noticeable is the dominant role of noncognitive skills and health for both outcomes, which combined explain over 15 percent and 30 percent of the differences in the probabilities of welfare dependence and subjective poverty, respectively.

Figure 5. Decomposition of the treatment effect of neglect (0, 1) on age-55 economic outcomes by contributing factors measured at age 33.



Each bar represents the decomposition of the treatment effect of neglect on a specific economic outcome recorded at age 55 (earnings, poverty, welfare dependence) into the impact of neglect on young adulthood outcomes (cognitive skills, noncognitve skills, phys./mental health, education, family factors, employment) and unobservable factors. Each bar stacks the scaled, absolute percent contribution of age 33 outcomes (age 16 for cognitive skills) to the treatment effect of neglect. Welfare dependence is a dummy variable that takes the value 1 if an individual is welfare dependent, and 0 otherwise. Poverty is a dummy variable that takes the value 1 if an individual reports that it is hard to get by financially, and 0 otherwise. Child neglect is a dummy variable that takes the value 1 if the teacher assessed the child to appear malnourished or dirty by age 11. The predicted difference in outcomes between treatment and control groups are, respectively: Earnings: 19.9 percent, Welfare dependence 7.1 percent; and Subjective poverty: 3.5 percent. The estimation sample sizes are, respectively: Earnings N=2,146, Welfare: N=3,782, Subjective poverty: N=3,746. Full estimation results are presented in Table A7 in the appendix.

6. DISCUSSION AND CONCLUSION

This study quantifies the degree to which early-life adverse childhood experiences (ACEs) are associated with later-life economic outcomes; it identifies the core components of adversity that are linked with economic outcomes; and it shows the likely mechanisms through which this link is established. This study is built upon the assumption that what matters for the life trajectories of children is not only lack of access to income or educational resources but also confrontation with negative, chronic life events. Such an assumption has important implications, because it presents the idea that some children from disadvantaged families are not at risk of later-life disadvantage, and – crucially – that some children in economically privileged families are very much at risk of later-life disadvantage.

Using high-quality British cohort data, this is one of the first studies to quantify the earnings disparity for people with ACEs and the role of adverse experiences in later-life welfare dependence and (subjective) poverty. Such obstacles – which include out-of-home care, neglect, separation from parents, and a host of other negative experiences – occur disproportionately in economically disadvantaged families, but they exist within privileged households as well. We estimate a later-life earnings disparity of 20 percent for children with high-dose (two or more) ACEs. Strong associations were similarly found for welfare dependence. Of all the components in our ACE index, teacher-assessed neglect yields the strongest association with age-55 earnings (23 percent). Although these findings cannot be interpreted as causal, they suggest that what a teacher observes is a powerful predictor of lifetime outcomes – and they carry important implications for policy makers. We demonstrate that the earnings penalty of neglect is almost exclusively explained by differences in human capital attainment by age 33.

The key limitation of our study is that we cannot interpret our findings as causal even though we control for a significant number of early-childhood factors, including health at birth, parental socioeconomic status, and the number of siblings in the households. But because of unobserved confounding factors we cannot say for sure that if cohort members had not experienced ACEs they would earn similar salaries or face similar rates of welfare dependence as cohort members who did not. In other words, there may be unobservable factors that occur in the life of the child between age 7 and 16 that correlate with one of the ACE components and affect health and human capital accumulation, thus shaping later-life economic outcomes. For example, a factor could be parental cognitive ability or parental financial income, which we only measure through approximations (parental education, father's occupational status, region of residence). One way to overcome such a problem is to use siblings- or twin-fixed-effects methodologies that more carefully control for fixed family factors. These methods are used in Fletcher and Schurer (2017), Currie and Tekin (2012), and Slade and Wissow (2007) to identify the causal impact of maltreatment

experiences on personality, crime, and education in young adulthood, respectively. Unfortunately, the NCDS does not provide siblings information.

Another important limitation of our study is that, although we initially have information on 18,558 cohort members at sweep 0 (age 0-1), our final estimation sample is greatly reduced by sample attrition due to systematic dropout. In a descriptive analysis of comparing ACEs and pre-treatment covariate means between final members and dropouts demonstrates that we lose cohort members with higher ACE rates as well as those from poorer socioeconomic backgrounds in childhood. If these same cohort members respond most strongly to the experience of ACEs in terms of health and human capital accumulation and labor market outcomes, then we are likely to underestimate the impact of ACEs on later-life economic indicators. For these reasons, we interpret our estimation results as a conservative estimate.

Since we find that ACEs are significantly associated with later-life economic outcomes, independent of socioeconomic status, this research contributes to a new way of thinking about and defining childhood poverty. Standard definitions are based on disposable household income thresholds, adjusting for family size and composition (Roosa et al. 2005, Whiteford and Adema 2007, Adamson 2012). Although we do not measure income poverty in a rigorous way, we are able to demonstrate that maltreatment exposure matters in the long run, regardless of whether a child is deemed disadvantaged. One recommendation of our study could be to better resources child protective services to be able to be at the forefront of battling childhood adversity. A few recent economic evaluations calculated that non-fatal child maltreatment has an estimated average lifetime cost of US$210,012 per victim in the US (Fang et al. 2012); of £89,390 (US$127,000) in the UK (Conti et al. 2017); and of A$176,437 (US$142,125) in Australia (McCarthy et al. 2016). Hence, large public savings may be achieved if children exposed to maltreatment were targeted and nurtured early on. Although child protective services are very expensive, and case workers are often overwhelmed by the complexity of the family dynamics they work with (Ferguson 2016), more can be done to reduce adverse experiences and inequality among children as well as the vicious cycle of intergenerational maltreatment (Schelbe and Geiger 2017). Another potential avenue for policymakers to support families and protect children could be to direct resources to parenting interventions in primary care (see Brockmeyer et al 2016 and references therein) or family-home visiting programs (see Huston 2011 and references therein). Putting children at risk on a path of health and success in life might therefore start with thinking outside the cash-transfer box.

ACKNOWLEDGMENT

We are grateful to Tara Hariharan, Serena Renner, colleagues from the School of Economics at the University of Sydney, and participants of the NCDS 60 Years of Our Lives conference for valuable comments. Stefanie Schurer acknowledges funding from an Australian Research Council Early Career Discovery Program Grant (DE140100463) and the Australian Research Council Centre of Excellence for Children and Families over the Life Course (project number CE140100027).

REFERENCES

Adamson, P. (2012). *Measuring child poverty: New league tables of child poverty in the world's rich countries* (No. inreca660), https://www.unicef-irc.org/publications/660/ .

Amato, P.R. (1988). Long-term implications of parental divorce for adult self-concept. *Journal of Family Issues*, *9*(2), 201-213.

Amato, P.R. (2000). The consequences of divorce for adults and children. *Journal of Marriage and the Family,* 62(4), 1269-1287.

Anda, R.F., Felitti, V.J., Bremner, J.D., Walker, J.D., Whitfield, C.H., Perry, B.D., Dube, S.R., Giles, W.H. (2006). The enduring effects of abuse and related adverse experiences in childhood. *European Archives of Psychiatry and Clinical Neuroscience*, *256*(3), 174-186.

Australian Institute of Health and Welfare (2017). Child protection Australia 2015–16. Child Welfare series no. 66. Cat. no. CWS 60. Canberra: AIHW.

Barajas R.J., Philipsen N., Brooks-Gunn, J. (2007). Cognitive and emotional outcomes for children in poverty. In: Crane DR, Heaton TB, editors. Handbook of Families and Poverty. Thousand Oaks, CA: Sage. pp. 311–333.

Bird K. (2013). The Intergenerational Transmission of Poverty: An Overview. In: Shepherd A., Brunt, J. (eds) Chronic Poverty. Rethinking International Development Series. Palgrave Macmillan, London.

Black, S.E., Devereux, P.J., Salvanes, K.G. (2005). The more the merrier? The effect of family size and birth order on children's education. *The Quarterly Journal of Economics*, *120*(2), 669-700.

Blanden, J., Hansen, K., Machin, S. (2010). The Economic Cost of Growing Up Poor: Estimating the GDP Loss Associated with Child Poverty. *Fiscal Studies*, 31, 289–311.

Bradley R.H., Corwyn, R.F. (2002). Socioeconomic status and child development. Annual Review of Psychology 53: 371–399.

Boden, J.M., Horwood, L.J., Fergusson, D.M. (2007). Exposure to childhood sexual and physical abuse and subsequent educational achievement outcomes. *Child Abuse & Neglect*, *31*(10), 1101-1114.

Brockmeyer Cates, C., Weisleder, A., Mendelsohn, A.L. (2016). Mitigating the effects of family poverty on early child development through parenting interventions in primary care. *Academic Pediatrics* 16(3), S112-S112.

Brown D.W., Anda, R.F., Tiemeier, H., Felitti, V.J., Edwards, V.J., Croft, J.B., Giles, W.H. (2009). Adverse Childhood Experiences and the Risk of Premature Mortality. *American Journal of Preventive Medicine*, 37(5), 389 – 396.

Brown, G.W., Harris, T. (1978). Social origins of depression: A study of psychiatric disorder in women. Routledge.

Brown, S.A., Tapert, S.F., Granholm, E., Delis, D.C. (2000). Neurocognitive functioning of adolescents: Effects of protracted alcohol use. *Alcoholism: Clinical and Experimental Research*, *24*(2), 164-171.

Cancian, M., Shook Slack, K., Yang, M.Y. (2010). *The effect of family income on risk of child maltreatment.* Institute for Research on Poverty, Discussion Paper no. 1385-10, University of Wisconsin-Madison Madison, WI.

Case, A., Fertig, A., Paxson, C. (2005). The lasting impact of childhood health and circumstance. *Journal of Health Economics* 24(2), 365–389.

Case, A., Lubotsky, D., Paxson, C. (2002). Economic status and health in childhood: The origins of the gradient. *American Economic Review,* 92(5), 1308-1333.

Chang, L. (1994). A psychometric evaluation of 4-point and 6-point Likert-type scales in relation to reliability and validity. *Applied Psychological Measurement*, *18*(3), 205-215.

Clark, C., Caldwell, T., Power, C., Stansfeld, S.A. (2010). Does the influence of childhood adversity on psychopathology persist across the lifecourse? A 45-year prospective epidemiologic study. *Annals of Epidemiology*, *20*(5), 385-394.

Cobb-Clark, D., Salamanca, N., and Zhu, A. (2016) Parenting Style as an Investment in Human Development. IZA Discussion Paper: 9686 (2016-01).

Cohen, S., Janicki-Deverts D., Chen E., Matthews K.A. (2010). Childhood socioeconomic status and adult health. *Annals of the New York Academy of Sciences*, 1186(1), 37–55.

Conti, G., Morris, S., Melnychuk, M.P., Izzo, E. (2017). The economic cost of child maltreatment in the UK: a preliminary study. London: NSPCC.

Corcoran, M. (1995). Rags to rags: Poverty and mobility in the United States. *Annual Review of Sociology*, *21*(1), 237-267.

Covey, H. C., Menard, S., Franzese, R. J. (2013). Effects of adolescent physical abuse, exposure to neighborhood violence, and witnessing parental violence on adult socioeconomic status. *Child Maltreatment*, 18(2), 85-97.

Currie, J. (2009). Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development. *Journal of Economic Literature,* 47(1), 87-122.

Currie, J., Tekin, E. (2012). Understanding the cycle of childhood maltreatment and future crime. *Journal of Human Resources*, *47*(2), 509-549.

Currie, J., Widom, C.S. (2010). Long-term consequences of child abuse and neglect on adult economic well-being. *Child Maltreatment*, 15(2), 111–120.

Dahl, G. B., Lochner, L. (2012). The impact of family income on child achievement: Evidence from the earned income tax credit. *The American Economic Review,* 102(5), 1927-1956.

Danese, A., Moffitt, T.E., Harrington, H., Milne, B.J., Polanczyk, G., Pariante, C.M., Poulton, R., Caspi, A. (2009). Adverse childhood experiences and adult risk factors for age-related disease:

depression, inflammation, and clustering of metabolic risk markers. *Archives of Pediatrics & Adolescent Medicine*, *163*(12), 1135-1143.

Department for Work and Pensions (2017). Policy Paper 2010 to 2015 government policy: welfare reform, London, viewed 19 April 2017, https://www.gov.uk/government/publications/2010-to-2015-government-policy-welfare-reform/2010-to-2015-government-policy-welfare-reform.

Dong, M., Dube, S.R., Felitti, V.J., Giles, W.H., Anda R.F. (2003). Adverse childhood experiences and self-reported liver disease: new insights into the causal pathway. *Archives of Internal Medicine*, 163(16), 1949-1956.

Dong, M., Giles, W.H., Felitti, V.J., Dube, S.R., Williams, J.E., Chapman, D.P., Anda, R.F. (2004). Insights into causal pathways for ischemic heart disease adverse childhood experiences study. *Circulation,* 110(13), 1761-1766.

Dube, S.R., Felitti, V.J., Dong, M., Giles, W.H., Anda, R.F. (2003). The impact of adverse childhood experiences on health problems: evidence from four birth cohorts dating back to 1900. *Preventive Medicine*, *37*(3), 268-277.

Duncan, G., Yeung, W., Brooks-Gunn, J., Smith, J. (1998). How much does childhood poverty affect children's life chances?, *American Sociological Review*, 63, 406-423.

Duncan, G., Ziol-Guest, K., Kalil, A. (2010). Early-childhood poverty and adult attainment behavior, and health. *Child Development*, 81(1), 306-325.

Duncan, G., Magnuson, K., Kalil, A., Ziol-Guest, K. (2012). The importance of early childhood poverty. *Social Indicators Research*, 108(1), 87-98.

Evans, G.E. (2004). The environment of childhood poverty. *American Psychologist* 59(2), 77-92.

Evans G.W., Kim, P. (2010). Multiple risk exposure as a potential explanatory mechanism for the socioeconomic status-health gradient. *Annual New York Academy of Sciences*, 1186, 174–189.

Fang, X., Brown, D.S., Florence, C.S., Mercy, J.A. (2012). The economic burden of child maltreatment in the United States and implications for prevention. *Child Abuse & Neglect*, *36*(2), 156-165.

Felitti, V.J., Anda, R.F., Nordenberg, D., Williamson, D.F., Spitz, A.M., Edwards, V., Koss, M.P., Marks, J.S., 1998. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*, *14*(4), 245-258.

Ferguson, H. (2016). How Children Become Invisible in Child Protection Work: Findings from Research into Day-to-Day Social Work Practice. *The British Journal of Social Work*, 47(4), 1007-1023.

Fletcher, J. M. (2009). Childhood mistreatment and adolescent and young adult depression. *Social Science & Medicine,* 68(5), 799–806.

Fletcher, J.M., Schurer, S. (2017). Origins of adulthood personality: The role of adverse childhood experiences. *The B.E. Journal of Economic Analysis & Policy*, 366.

Font, S.A., Maguire-Jack, K. (2016). Pathways from childhood abuse and other adversities to adult health risks: The role of adult socioeconomic conditions. *Child Abuse & Neglect*, *51*, 390-399.

Fortin, N., Lemieux, T., Firpo, S. (2011). Decomposition methods in economics. *Handbook of Labor Economics*, *4*, 1-102.

Gaitz, J., Schurer, S. (2017). Bonus skills: Examining the effect of an Australian unconditional cash transfer on child development. LCC Working Paper nr 2017-04.

Gershoff E.T., Aber J.L., Raver C.C., Lennon M.C. (2007). Income Is Not Enough: Incorporating Material Hardship Into Models of Income Associations With Parenting and Child Development. *Child Development*, 78, 70–95.

Goldberg, X., Alemany S., Fatjó-Vilas M., González-Ortega I., González-Pinto A., Cuesta M.J., Fañanás L. (2013). Twin-based study of the complex interplay between childhood maltreatment, socioeconomic status and adult memory. *European Archives of Psychiatry and Clinical Neuroscience* 263(5), 435–440.

Hanson, J.L,. Hair, N., Shen, D.G., Shi, F., Gilmore, J.H. et al. (2013) Family Poverty Affects the Rate of Human Infant Brain Growth. *PLoS ONE* 8(12): e80954.

Hardt, J., Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *Journal of Child Psychology and Psychiatry,* 45(2), 260–273.

Hariharan, T., Schurer, S. (2017). Child maltreatment and lifetime health outcomes: Evidence from the National Child Development Study. Unpublished manuscript. Mimeo.

Hart B., Risley T.R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore: Paul Brookes.

Heckman, James J. (2011). The American family in black and white: A post-racial strategy for improving skills to promote equality. Daedalus 140(2), 70-89.

Heckman, J., Pinto, R., Savelyev, P. (2013). Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *The American Economic Review*, *103*(6), 2052-2086.

Heckman, J. J. & Mosso, S. The Economics of Human Development and Social Mobility. *Annual Review of Economics* 6, 689-733.

Heckman, J.J., Pinto, R. (2015). Econometric mediation analyses: Identifying the sources of treatment effects from experimentally estimated production technologies with unmeasured and mismeasured inputs. *Econometric Reviews*, *34*(1-2), 6-31.

Holzer, H., Whitmore Schanzenbach, D., Duncan, G., Ludwig, J. (2007), The Economic Costs of Poverty in the United States: Subsequent Effects of Children Growing Up Poor, Washington, DC: Center for American Progress.

Huston, A.C. (2011). Children in poverty. Can public policy alleviate the consequences? *Family Matters* 87, 13-26.

Isohookana, R., Marttunen, M., Hakko, H., Riipinen, P., Riala, K. (2016). The impact of adverse childhood experiences on obesity and unhealthy weight control behaviors among adolescents. *Comprehensive Psychiatry*, *71*, 17-24.

Johnson, R.C., Schoeni, R.F. (2011). The influence of early-life events on human capital, health status, and labor market outcomes over the life course. *The B.E. Journal of Economic Analysis & Policy*, *11*(3).

Kelly-Irving, M., Lepage, B., Dedieu, D., Bartley, M., Blane, D., Grosclaude, P., Lang, T., Delpierre, C. (2013). Adverse childhood experiences and premature all-cause mortality. *European Journal of Epidemiology*, *28*(9), 721-734.

Kelly-Irving, M., Lepage, B., Dedieu, D., Lacey, R., Cable, N., Bartley, M., Blane, D., Grosclaude, P., Lang, T., Delpierre, C. (2013). Childhood adversity as a risk for cancer: findings from the 1958 British birth cohort study. *BMC Public Health*, *13*(1), 767.

Liu, Y., Croft, J.B., Chapman, D.P., Perry, G.S., Greenlund, K.J., Zhao, G., Edwards, V.J. (2013). Relationship between adverse childhood experiences and unemployment among adults from five US states. *Social Psychiatry and Psychiatric Epidemiology*, *48*(3), 357-369.

Magnuson, K. A., Votruba-Drzal, E. (2008). Enduring influences of childhood poverty. *Focus,* 26(2), 32-37.

McCarthy, M.M., Taylor, P., Norman, R.E., Pezzullo, L., Tucci, J., Goddarg, C. (2016). The lifetime economic and social costs of child maltreatment in Australia. *Children and Youth Services Review*, 71, 217–226.

Merrick, M.T., Ports, K.A., Ford, D.C., Afifi, T.O., Gershoff, E.T., Grogan-Kaylor, A. (2017). Unpacking the impact of adverse childhood experiences on adult mental health. *Child Abuse & Neglect*, *69*, 10-19.

Mersky, J.P., Topitzes, J., Reynolds, A.J. (2013). Impacts of adverse childhood experiences on health, mental health, and substance use in early adulthood: A cohort study of an urban, minority sample in the US. *Child Abuse & Neglect*, *37*(11), 917-925.

Metzler, M., Merrick, M.T., Klevens, J., Ports, K.A., Ford, D.C. (2017). Adverse childhood experiences and life opportunities: Shifting the narrative. *Children and Youth Services Review*, *72*, 141-149.

National Society for the Prevention of Cruelty to Children (2017), *Child Protection Plan and Register Statistics: UK 2012-2016*, viewed 4 October 2017, https://www.nspcc.org.uk/globalassets/documents/statistics-and-information/child-protection-register-statistics-united-kingdom.pdf

Noble, K. G., Houston, S, M., Brito, N. H., Bartsch, H., Kan, E., Kuperman, J. M. et al. (2015). Family income, parental education and brain structure in children and adolescents. *Nature Neuroscience*, *18*(5), 773-778.

Power, C., Elliott, J. (2006). Cohort profile: 1958 British birth cohort (national child development study). *International Journal of Epidemiology*, *35*(1), 34-41.

Richards, M., Wadsworth, M.E.J. (2004). Long term effects of early adversity on cognitive function. *Archives of Disease in Childhood*, *89*(10), 922-927.

Roosa, M.W., Deng, S., Nair, R.L., Lockhart Burrell, G., (2005). Measures for studying poverty in family and child research. *Journal of Marriage and Family*, *67*(4), 971-988.

Sansone, R.A., Leung, J.S., Wiederman, M.W. (2012). Five forms of childhood trauma: Relationships with employment in adulthood. *Child Abuse & Neglect*, 36(9), 676-679.

Schelbe L., Geiger J.M. (2017). *What Is Intergenerational Transmission of Child Maltreatment?. In: Intergenerational Transmission of Child Maltreatment*. Springer Briefs in Social Work. Springer, Cham, 1-14.

Schilling, E.A., Aseltine, R.H., Gore, S. (2007). Adverse childhood experiences and mental health in young adults: a longitudinal survey. *BMC Public Health*, *7*(1), 30.

Slade, E.P., Wissow, L.S. (2007). The influence of childhood maltreatment on adolescents' academic performance. *Economics of Education Review*, *26*(5), 604-614.

Solís, C.B., Kelly-Irving, M., Fantin, R., Darnaudéry, M., Torrisani, J., Lang, T., Delpierre, C., (2015). Adverse childhood experiences and physiological wear-and-tear in midlife: Findings from the 1958 British birth cohort. *Proceedings of the National Academy of Sciences*, *112*(7), E738-E746.

Thomas, C., Hyppönen, E., Power, C. (2008). Obesity and type 2 diabetes risk in mid adult life: the role of childhood adversity. *Pediatrics*, 121(5), e1240–e1249.

United Nations Children's Fund: UNICEF (2012). *Progress for Children: A report card on adolescents*, No. 10.

Whiteford, P., Adema, W. (2007). *What Works Best In Reducing Child Poverty: A Benefit Or Work Strategy?* Organisation for Economic Cooperation and Development (OECD), Paris.

Wiborg, O., Hansen, M. (2009). Change over time in the intergenerational transmission of social disadvantage. *European Sociological Review,* 25(3), 379-394.

Widom, C.S. (1989). Child Abuse, Neglect, and Adult Behavior: Research Design and Findings on Criminality, Violence, and Child Abuse. *American Journal of Orthopsychiatry,* 59(3), 355.

Widom, C.S., Raphael, K.G., DuMont, K.A. (2004). The case for prospective longitudinal studies in child maltreatment research: commentary on Dube, Williamson, Thompson, Felitti, and Anda (2004). *Child Abuse & Neglect,* 28(7), 715-722.

Wodarski, J.S., Kurtz, P.D., Gaudin, J.M., Howing, P.T. (1990). Maltreatment and the school-age child: Major academic, socioemotional, and adaptive outcomes. *Social Work*, *35*(6), 506-513.

Young, J.C., Widom, C. S. (2014). Long-term effects of child abuse and neglect on emotion processing in adulthood. *Child Abuse & Neglect,* 38(8), 1369-1381.

APPENDIX

Table A1. Full estimation results on relationship between ACE (0,6) and log net earnings measured at age 55, adding subsequent blocks of control variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ACE Index (0-6)	-0.106***	-0.100***	-0.105***	-0.087***	-0.107***	-0.083**	-0.094***	-0.107***	-0.073**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Female		-0.404***							-0.406***
		(0.03)							(0.03)
Low birth weight			-0.008						-0.013
			(0.07)						(0.07)
Born <36 weeks			-0.097						-0.048
			(0.13)						(0.12)
2 siblings (base: 1 sibling)				0.072					0.032
				(0.07)					(0.06)
3 siblings				-0.002					-0.048
				(0.07)					(0.07)
4 (+) siblings				-0.089					-0.010
				(0.07)					(0.07)
Teenage mom (age < 20)					-0.012				0.062
					(0.08)				(0.08)
Mom age 20-34					0				0
					(.)				(.)
Mature mother (age>34)					0.030				0.071
					(0.05)				(0.05)
No father (base: skill-man.)						0.048			0.098
						(0.14)			(0.14)
Manager						0.393***			0.166**
						(0.07)			(0.08)
Professional						0.257***			0.145***
						(0.05)			(0.05)
Skilled non-manual						0.196***			0.132**
						(0.06)			(0.05)
Unskilled non-manual						0.211			0.157
						(0.13)			(0.13)
Unskilled non-manual						-0.048			-0.033
						(0.05)			(0.05)

Not determined						-0.036			-0.009
						(0.08)			(0.08)
Age father left education							0.052***		0.037***
							(0.01)		(0.01)
Age mother left education							0.032**		0.028**
							(0.01)		(0.01)
Age 0 region child lives=1								-0.071	-0.027
								(0.07)	(0.07)
Age 0 region child lives=2								0.022	0.053
								(0.06)	(0.06)
Age 0 region child lives=3								0.027	0.037
								(0.07)	(0.07)
Age 0 region child lives=4								-0.049	-0.044
								(0.07)	(0.07)
Age 0 region child lives=5								-0.130*	-0.098
								(0.07)	(0.07)
Age 0 region child lives=6								0.009	0.004
								(0.07)	(0.07)
Age 0 region child lives=8								0.025	0.040
								(0.08)	(0.08)
Age 0 region child lives=9								-0.045	-0.013
								(0.08)	(0.08)
Age 0 region child lives=10								-0.086	-0.059
								(0.08)	(0.08)
Age 0 region child lives=11								-0.047	0.006
								(0.06)	(0.06)
Sigma constant	7.151***	7.370***	7.153***	7.143***	7.147***	7.063***	5.877***	7.178***	6.362***
	(0.02)	(0.03)	(0.02)	(0.06)	(0.02)	(0.03)	(0.16)	(0.04)	(0.19)
Constant	0.899***	0.876***	0.898***	0.896***	0.898***	0.888***	0.887***	0.897***	0.858***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observation	2793	2793	2793	2793	2793	2793	2793	2793	2793

Note: Dependent variable is net earnings for column 1 to 9. Column (1) computes ACE on log net earnings without any controls. Columns (2) to (9) include regressions of ACE on net earnings by adding sets of control variables. Column (2) includes controls for gender. Column (3) includes controls for health of the child at birth. Column (4) includes controls for number of siblings in the family. Column (5) controls for characteristics of the mother. Column (6) includes controls for the father (if applicable) and the father's job classification. Column (7) controls for age parents left full-time education. Column (8) controls for geographic location where cohort member was born. Column (9) regresses ACE on net earnings controlling all the factors in Columns (2) to (8). Standard errors are reported in parentheses. Significance levels: *** 0.01 ** 0.05 * 0.10.

Table A2: Relationship between ACE (0,6) and economic outcomes at age 55

	(1) Any earnings	(2) Net income (>0)	(3) Welfare	(4) Poverty
ACE index (0-6)	-0.083***	-0.192**	0.106***	0.031
	(0.02)	(0.09)	(0.03)	(0.02)
Female	0.057***	-0.406***	-0.018*	0.003
	(0.01)	(0.03)	(0.01)	(0.01)
Low birth weight	-0.014	-0.011	0.007	-0.017
	(0.02)	(0.07)	(0.02)	(0.02)
Born < 36 weeks	-0.047	-0.060	0.003	0.051*
	(0.03)	(0.12)	(0.04)	(0.03)
1 sibling	0	0	0	0
	(.)	(.)	(.)	(.)
2 siblings	0.021	0.034	-0.020	-0.003
	(0.02)	(0.06)	(0.02)	(0.02)
3 siblings	0.009	-0.048	-0.007	0.008
	(0.02)	(0.07)	(0.02)	(0.02)
4 (+) siblings	-0.011	-0.098	0.004	0.004
	(0.02)	(0.07)	(0.02)	(0.02)
Teenage mom (age < 20)	-0.009	0.055	-0.013	0.066***
	(0.02)	(0.08)	(0.03)	(0.02)
Mom age 20-34	0	0	0	0
	(.)	(.)	(.)	(.)
Mature mother (age>34)	0.019	0.068	-0.006	0.014
	(0.02)	(0.05)	(0.02)	(0.01)
No father	-0.039	0.061	0.031	0.076**
	(0.04)	(0.13)	(0.04)	(0.03)
Manager/legislator	0.031	0.167**	0.005	0.03
	(0.03)	(0.08)	(0.03)	(0.02)
Professional	0.011	0.145***	-0.003	0.013
	(0.02)	(0.05)	(0.02)	(0.01)
Skilled non-manual	0.019	0.132**	-0.022	0.005
	(0.02)	(0.06)	(0.02)	(0.01)
Skilled manual	0	0	0	0
	(.)	(.)	(.)	(.)
Unskilled non-manual	-0.025	0.147	0.04	0.064**
	(0.04)	(0.13)	(0.04)	(0.03)
Unskilled non-manual	-0.029*	-0.033	0.022	0.030**
	(0.02)	(0.05)	(0.02)	(0.01)
Undetermined	-0.055**	-0.014	0.034	0.023
	(0.02)	(0.08)	(0.03)	(0.02)
Age father left education	0.010***	0.037***	0.001	-0.005**
	(0.00)	(0.01)	(0.00)	(0.00)
Age mother left education	-0.006	0.028**	-0.001	0.003
	(0.00)	(0.01)	(0.00)	(0.00)
Age 0 region child lives=1	0.017	-0.027	0.007	-0.002
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=2	0.015	0.051	-0.018	0.008
	(0.02)	(0.06)	(0.02)	(0.01)
Age 0 region child lives=3	0.010	0.039	-0.019	-0.013
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=4	0.017	-0.046	-0.021	-0.002
	(0.02)	(0.07)	(0.02)	(0.02)

Age 0 region child lives=5	0.001	-0.010	-0.008	-0.025
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=6	0.028	0.003	-0.005	-0.015
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=7	0	0	0	0
	(.)	(.)	(.)	(.)
Age 0 region child lives=8	0.028	0.037	-0.037	-0.025
	(0.03)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=9	0.034	-0.011	-0.056**	-0.007
	(0.02)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=10	0.014	-0.058	0.012	-0.037*
	(0.03)	(0.08)	(0.03)	(0.02)
Age 0 region child lives=11	0.013	0.010	-0.046**	0.002
	(0.02)	(0.06)	(0.02)	(0.02)
Constant	0.236***	6.350***	0.190***	0.108**
	(0.06)	(0.19)	(0.06)	(0.05)
Observations	8478	2793	5084	5047

Note: Dependent variables are: Column (1) log of net monthly salary for individuals with less than 20,000 pounds per month (including zero earnings). Column (2) log of net monthly salary for individuals with positive earnings only. Column (3) welfare dependence takes the value 1 if individual received any government transfers including other forms of income, benefits or tax credits, and 0 otherwise. Column (4): Subjective poverty takes the value 1 if currently finding it quite or very difficult to manage financially, and 0 otherwise (comfortably, living alright, or just getting by). Standard errors are reported in parentheses. Significance levels: ***0.01 **0.05 *0.10.

Table A3: Relationship between ACE (excl. separation) and economic outcomes at age 55

	(1) Any earnings	(2) Net income (>0)	(3) Welfare	(4) Poverty
ACE index (excl. separation)	-0.066***	-0.092**	0.066***	0.046***
	(0.01)	(0.05)	(0.01)	(0.01)
Female	0.057***	-0.407***	-0.017	0.003
	(0.01)	(0.03)	(0.01)	(0.01)
Low birth weight	-0.013	-0.014	0.009	-0.018
	(0.02)	(0.07)	(0.02)	(0.02)
Born < 36 weeks	-0.045	-0.053	0.001	0.049*
	(0.03)	(0.12)	(0.04)	(0.03)
1 sibling	0	0	0	0
	(.)	(.)	(.)	(.)
2 siblings	0.022	0.034	-0.021	-0.004
	(0.02)	(0.06)	(0.02)	(0.02)
3 siblings	0.011	-0.047	-0.009	0.007
	(0.02)	(0.07)	(0.02)	(0.02)
4 (+) siblings	-0.001	-0.094	-0.002	-0.003
	(0.02)	(0.07)	(0.02)	(0.02)
Teenage mom (age < 20)	-0.008	0.056	-0.014	0.063***
	(0.02)	(0.08)	(0.03)	(0.02)
Mom age 20-34	0	0	0	0
	(.)	(.)	(.)	(.)
Mature mother (age>34)	0.019	0.068	-0.006	0.014
	(0.02)	(0.05)	(0.02)	(0.01)
No father	-0.039	0.045	0.039	0.072**
	(0.04)	(0.13)	(0.04)	(0.03)
Manager/legislator	0.030	0.169**	0.005	0.028
	(0.03)	(0.08)	(0.03)	(0.02)
Professional	0.010	0.145***	-0.002	0.015
	(0.02)	(0.05)	(0.02)	(0.01)
Skilled non-manual	0.018	0.135**	-0.022	0.006
	(0.02)	(0.06)	(0.02)	(0.01)
Skilled manual	0	0	0	0
	(.)	(.)	(.)	(.)
Unskilled non-manual	-0.022	0.156	0.037	0.062*
	(0.04)	(0.13)	(0.04)	(0.03)
Unskilled non-manual	-0.027*	-0.031	0.021	0.029**
	(0.02)	(0.05)	(0.02)	(0.01)
Undetermined	-0.047**	-0.005	0.025	0.013
	(0.02)	(0.08)	(0.03)	(0.02)
Age father left education	0.010***	0.036***	0.001	-0.005**
	(0.00)	(0.01)	(0.00)	(0.00)
Age mother left education	-0.005	0.028**	-0.001	0.004
	(0.00)	(0.01)	(0.00)	(0.00)
Age 0 region child lives=1	0.018	-0.027	0.006	-0.002
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=2	0.014	0.049	-0.016	0.009
	(0.02)	(0.06)	(0.02)	(0.01)
Age 0 region child lives=3	0.010	0.036	-0.018	-0.013
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=4	0.016	-0.047	-0.020	-0.001
	(0.02)	(0.07)	(0.02)	(0.02)

Age 0 region child lives=5	0.002	-0.099	-0.008	-0.025
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=6	0.028	0.003	-0.006	-0.015
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=7	0	0	0	0
	(.)	(.)	(.)	(.)
Age 0 region child lives=8	0.029	0.036	-0.037	-0.026
	(0.03)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=9	0.034	-0.011	-0.055**	-0.006
	(0.02)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=10	0.012	-0.061	0.014	-0.036*
	(0.03)	(0.08)	(0.03)	(0.02)
Age 0 region child lives=11	0.012	0.005	-0.044**	0.004
	(0.02)	(0.06)	(0.02)	(0.02)
Constant	0.246***	6.360***	0.185***	0.105**
	(0.06)	(0.19)	(0.06)	(0.05)
Observations	8478	2793	5084	5047

Note: ACE is a summary measure of all adverse life events excluding separation from parents due to parental death, divorce or separation. The dependent variables are: Column (1) log of net monthly salary for individuals with less than 20,000 pounds per month (including zero earnings). Column (2) log of net monthly salary for individuals with positive earnings only. Column (3) welfare dependence takes the value 1 if individual received any government transfers including other forms of income, benefits or tax credits, and 0 otherwise. Column (4): Subjective poverty takes the value 1 if currently finding it quite or very difficult to manage financially, and 0 otherwise (comfortably, living alright, or just getting by). Standard errors are reported in parentheses. Significance levels: ***0.01 **0.05 *0.10.

Table A4. Full estimation results of ACE without separation (0,1) and economic outcomes at age 55

	(1) Any earnings	(2) Net income (>0)	(3) Welfare	(4) Poverty
ACE dummy (excl. separation)	-0.135***	-0.181	0.144***	0.051
	(0.03)	(0.14)	(0.04)	(0.03)
Female	0.057***	-0.407***	-0.017*	0.003
	(0.01)	(0.03)	(0.01)	(0.01)
Low birth weight	-0.015	-0.012	0.009	-0.017
	(0.02)	(0.07)	(0.02)	(0.02)
Born < 36 weeks	-0.047	-0.057	0.004	0.051*
	(0.03)	(0.12)	(0.04)	(0.03)
1 sibling	0	0	0	0
	(.)	(.)	(.)	(.)
2 siblings	0.021	0.033	-0.020	-0.003
	(0.02)	(0.06)	(0.02)	(0.02)
3 siblings	0.009	-0.049	-0.007	0.008
	(0.02)	(0.07)	(0.02)	(0.02)
4 (+) siblings	-0.009	-0.103	0.004	0.003
	(0.02)	(0.07)	(0.02)	(0.02)
Teenage mom (age < 20)	-0.014	0.051	-0.008	0.067***
	(0.02)	(0.08)	(0.03)	(0.02)
Mom age 20-34	0	0	0	0
	(.)	(.)	(.)	(.)
Mature mother (age>34)	0.019	0.067	-0.006	0.014
	(0.02)	(0.05)	(0.02)	(0.01)
No father	-0.047	0.035	0.046	0.0796**
	(0.04)	(0.13)	(0.04)	(0.03)
Manager/legislator	0.032	0.172**	0.004	0.0264
	(0.03)	(0.08)	(0.03)	(0.02)
Professional	0.012	0.147***	-0.004	0.013
	(0.02)	(0.05)	(0.02)	(0.01)
Skilled non-manual	0.019	0.134**	-0.022	0.005
	(0.02)	(0.06)	(0.02)	(0.01)
Skilled manual	0	0	0	0
	(.)	(.)	(.)	(.)
Unskilled non-manual	-0.023	0.152	0.039	0.063*
	(0.04)	(0.13)	(0.04)	(0.03)
Unskilled non-manual	-0.029*	-0.035	0.023	0.030**
	(0.02)	(0.05)	(0.02)	(0.01)
Undetermined	-0.053**	-0.016	0.034	0.022
	(0.02)	(0.08)	(0.03)	(0.02)
Age father left education	0.009***	0.036***	0.001	-0.005**
	(0.00)	(0.01)	(0.00)	(0.00)
Age mother left education	-0.005	0.028**	-0.001	0.003
	(0.00)	(0.01)	(0.00)	(0.00)
Age 0 region child lives=1	0.019	-0.025	0.006	-0.002
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=2	0.016	0.053	-0.018	0.008
	(0.02)	(0.06)	(0.02)	(0.01)
Age 0 region child lives=3	0.010	0.037	-0.018	-0.013
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=4	0.018	-0.043	-0.022	-0.002
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=5	0.002	-0.098	-0.009	-0.03
	(0.02)	(0.07)	(0.02)	(0.02)

Age 0 region child lives=6	0.03	0.004	-0.006	-0.015
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=7	0	0	0	0
	(.)	(.)	(.)	(.)
Age 0 region child lives=8	0.029	0.035	-0.037	-0.026
	(0.03)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=9	0.035	-0.010	-0.057**	-0.007
	(0.02)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=10	0.013	-0.061	0.013	-0.037*
	(0.03)	(0.08)	(0.03)	(0.02)
Age 0 region child lives=11	0.013	0.008	-0.046**	0.002
	(0.02)	(0.06)	(0.02)	(0.02)
Constant	0.237***	6.354***	0.190***	0.108**
	(0.06)	(0.19)	(0.06)	(0.05)
Observations	8478	2793	5084	5047

Note: ACE (0, 1) is a binary measure that takes the value 1 if the cohort member experienced two or more adverse events (excluding separation from parents), and 0 otherwise. The dependent variables are: Column (1) log of net monthly salary for individuals with less than 20,000 pounds per month (including zero earnings). Column (2) log of net monthly salary for individuals with positive earnings only. Column (3) welfare dependence takes the value 1 if individual received any government transfers including other forms of income, benefits or tax credits, and 0 otherwise. Column (4): Subjective poverty takes the value 1 if currently finding it quite or very difficult to manage financially, and 0 otherwise (comfortably, living alright, or just getting by). Standard errors are reported in parentheses. Significance levels: ***0.01 **0.05 *0.10.

Table A5: Relationship between child neglect (0,1) and economic outcomes at age 55

	(1) Any earnings	(2) Net income (>0)	(3) Welfare	(4) Poverty
Child neglected age 7-11	-0.116***	-0.225**	0.132***	0.052**
	(0.02)	(0.09)	(0.03)	(0.02)
Female	0.055***	-0.405***	-0.011	0.006
	(0.01)	(0.04)	(0.01)	(0.01)
Low birth weight	-0.022	-0.022	-0.001	-0.024
	(0.02)	(0.07)	(0.02)	(0.02)
Born < 36 weeks	-0.043	-0.103	0.014	0.061**
	(0.04)	(0.13)	(0.04)	(0.03)
1 sibling	0	0	0	0
	(.)	(.)	(.)	(.)
2 siblings	0.027	0.050	-0.014	0.002
	(0.02)	(0.07)	(0.02)	(0.02)
3 siblings	0.016	-0.022	-0.006	0.019
	(0.02)	(0.07)	(0.02)	(0.02)
4 (+) siblings	0.012	-0.045	-0.005	0.003
	(0.02)	(0.07)	(0.02)	(0.02)
Teenage mom (age < 20)	-0.006	0.066	-0.031	0.080***
	(0.03)	(0.09)	(0.03)	(0.02)
Mom age 20-34	0	0	0	0
	(.)	(.)	(.)	(.)
Mature mother (age>34)	0.020	0.090*	-0.004	0.016
	(0.02)	(0.05)	(0.02)	(0.01)
No father	-0.074*	0.034	0.064	0.078**
	(0.04)	(0.15)	(0.04)	(0.04)
Manager/legislator	0.044	0.175**	0.0002	0.023
	(0.03)	(0.08)	(0.03)	(0.02)
Professional	0.014	0.143***	-0.004	0.020
	(0.02)	(0.05)	(0.02)	(0.01)
Skilled non-manual	0.016	0.154***	-0.014	0.011
	(0.02)	(0.06)	(0.02)	(0.01)
Skilled manual	0	0	0	0
	(.)	(.)	(.)	(.)
Unskilled non-manual	-0.006	0.110	0.023	0.053
	(0.04)	(0.14)	(0.04)	(0.03)
Unskilled non-manual	-0.024	-0.037	0.012	0.024*
	(0.02)	(0.05)	(0.02)	(0.01)
Undetermined	-0.046*	-0.017	0.038	0.024
	(0.02)	(0.08)	(0.03)	(0.02)
Age father left education	0.012***	0.035***	0.0018	-0.006**
	(0.00)	(0.01)	(0.00)	(0.00)
Age mother left education	-0.005	0.030**	0.002	0.005*
	(0.00)	(0.01)	(0.00)	(0.00)
Age 0 region child lives=1	0.028	-0.030	0.014	0.001
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=2	0.013	0.063	-0.007	0.007
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=3	0.019	0.048	-0.018	-0.015
	(0.02)	(0.07)	(0.02)	(0.02)
Age 0 region child lives=4	0.017	-0.063	-0.008	-0.010
	(0.02)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=5	0.007	-0.092	0.001	-0.025
	(0.02)	(0.07)	(0.02)	(0.02)

Age 0 region child lives=6	0.039	0.010	-0.003	-0.013
	(0.02)	(0.08)	(0.02)	(0.02)
Age 0 region child lives=7	0	0	0	0
	(.)	(.)	(.)	(.)
Age 0 region child lives=8	0.030	0.015	-0.024	-0.033
	(0.03)	(0.08)	(0.03)	(0.02)
Age 0 region child lives=9	0.029	0.007	-0.035	-0.015
	(0.03)	(0.08)	(0.03)	(0.02)
Age 0 region child lives=10	0.009	-0.066	0.034	-0.043**
	(0.03)	(0.09)	(0.03)	(0.02)
Age 0 region child lives=11	0.015	0.003	-0.039*	-0.001
	(0.02)	(0.07)	(0.02)	(0.02)
Constant	0.198***	6.322***	0.113*	0.083*
	(0.07)	(0.20)	(0.06)	(0.05)
Observations	7518	2489	4506	4470

Note: Child negelct (0, 1) is a binary measure that takes the value 1 if the cohort member was assessed malnourished or looking dirty by the school teacher by age 11, and 0 otherwise.. The dependent variables are: Column (1) log of net monthly salary for individuals with less than 20,000 pounds per month (including zero earnings). Column (2) log of net monthly salary for individuals with positive earnings only. Column (3) welfare dependence takes the value 1 if individual received any government transfers including other forms of income, benefits or tax credits, and 0 otherwise. Column (4): Subjective poverty takes the value 1 if currently finding it quite or very difficult to manage financially, and 0 otherwise (comfortably, living alright, or just getting by). Standard errors are reported in parentheses. Significance levels: ***0.01 **0.05 *0.10.

Table A6. Decomposition of treatment effect of high-dose ACE (≥2 events) on economic outcomes at age 55 into the effect of ACE on young adulthood outcomes (mainly age 33)

	Outcome		
	Log Earnings (0, 20K)	Welfare Dependence (0, 1)	Subjective Poverty (0, 1)
Outcome prediction			
Mean control group	7.153	0.140	0.0744
Mean treatment group	6.886	0.195	0.155
Difference in means	0.267***	-0.055*	-0.081***
Decomposition of ACE impact			
Cognitive skills (age 16)			
Math test score	0.0156	0.00243	-0.0026
Reading test score	0.0254**	-0.0085**	-0.0010
Noncognitive skills (age 33)	0.0123	-0.00189	-0.0022
Mental health (age 33)	0.0172	-0.0058*	-0.0075**
Physical health (age 33)	0.0170*	-0.0019	-0.0002
Highest qualification (age 33)	0.0927***	-0.0062	-0.0039
Married (age 33)	0.00004	0.0003	0.0001
Number of children (age 33)	-0.0041	0.0034*	0.0007
Zero working hours (age 33)	0.0048	-0.0004	-0.0017
Working hours < 35	0.0105	0.0014	-0.0004
Working hours > 50	0.0134**	-0.0002	0.0004
Unobserved factors	0.0619	-0.0380	-0.0623**
Observations	2,375	4,211	4,175

Note: Decomposition estimation results for equation (6). High-dose ACE takes the value 1 if the cohort member has experienced at least two adverse events, and 0 otherwise. One-sided p-values are reported. Decomposition analysis is conducted using -- oaxaca – command in STATA command. Significance levels: *** 0.01 ** 0.05 * 0.10.

Table A7. Decomposition of treatment effect of neglect on economic outcomes at age 55 into the effect of ACE on young adulthood outcomes (mainly age 33)

	Outcome		
	Log earnings	Welfare dependence	Subjective poverty
Outcome prediction			
Mean control group	7.142	0.136	0.0753
Mean treatment group	6.944	0.207	0.110
Difference in means	0.199*	-0.071**	-0.035
Decomposition of ACE impact			
Cognitive skills (age 16):			
Math test scores	0.0147	0.0031	-0.0011
Reading test scores	0.0499***	-0.0132**	-0.0043
Noncognitive skills (age 33)	0.0137	-0.0046*	-0.0042**
Mental health (age 33)	0.0160	-0.0059*	-0.0081**
Physical health (age 33)	0.0075	-0.0008	0.0004
Highest qualification (age 33)	0.1110***	-0.0048	-0.0051
Married (age 33)	0.0001	0.0002	0.0002
Number of children (age 33)	-0.0013	0.0008	0.0003
Zero working hours (age 33)	-0.0019	-0.0005	-0.0012
Working hours < 35	-0.0125	-0.000809	0.0003
Working hours > 50	0.0014	-0.0001	0.0002
Unobserved factors	-0.0003	-0.0442	-0.0124
Observations	2146	3782	3746

Note: Decomposition estimation results for equation (6). Neglect takes the value 1 if the cohort member was assessed malnourished or looking dirty by the school teacher by age 11, and 0 otherwise. One-sided p-values are reported. Decomposition analysis is conducted using -- oaxaca – command in STATA command. Significance levels: *** 0.01 ** 0.05 * 0.10.