

Negative childhood experiences and risk aversion: evidence from children exposed to domestic violence

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Abstract

Using a longitudinal study of 1,900 Peruvian children, I show that children who grown up in a household where mothers report experiencing domestic violence are more risk averse and have lower cognitive development. Risk attitudes are measured with an incentivized experiment. The effect of domestic violence on risk attitudes is not mediated by cognitive development and suggests that early negative experiences in life can directly influence the risk attitudes of children. This experience is associated with other behavioral changes as well.

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1 Introduction

According to the United Nations Children’s Fund (UNICEF) 133 to 275 million children are exposed to domestic violence every year (UNICEF, 2006).¹ Exposure to domestic violence has been associated with a myriad of negative outcomes that includes impaired cognitive development (Koenen, Moffitt, Caspi, Taylor, and Purcell, 2003), an increase in externalizing and internalizing behaviors (Emery, 2011; Fantuzzo and Mohr, 1999; Kernic, Wolf, Holt, McKnight, Huebner, and Rivara, 2003; Osofsky, 1999), and an increased likelihood of several health conditions (Brown, Anda, Tiemeier, Felitti, Edwards, Croft, and Giles, 2009; Felitti, Anda, Nordenberg, Williamson, Spitz, Edwards, Koss, and Marks, 1998). Research suggests that adverse childhood experiences might not only be associated with lasting changes in the nervous, endocrine and immune systems (Danese and McEwen, 2012), but also with lifetime earnings through their effect on cognitive and non-cognitive abilities (Carrell and Hoekstra, 2010; Currie and Tekin, 2006; Gertler, Heckman, Pinto, Zanolini, Vermeersch, Walker, Chang, and Grantham-Zmcgregor, 2013; Heckman, Pinto, and Saveleyev, 2013; Heckman, Stixrud, and Urzua, 2006). In this paper, I show that growing up in a household where domestic violence occurs can directly alter the risk attitudes of children as well.

The result is important because children make many consequential and unsupervised decisions (Bertrand and Pan, 2013; Castillo, Jordan, and Petrie, 2016; Castillo, Ferraro, Jordan, and Petrie, 2011; Segal, 2013; Sutter, Kocher, Glaetzle-Ruetzler, and Trautmann, 2013) and these decisions are correlated with their preferences (Castillo et al., 2011; Golsteyn, Gronqvist, and Lindahl, 2014; Sutter et al., 2013). Early adverse experiences can then affect future outcomes by changing the way children evaluate options. In particular, increased risk aversion might be costly in the long-term if it prevents a child from taking advantage of opportunities available and/or if it stunts personal development.

This paper aims to improve our understanding of the determinants of individual preferences and the role the household environment plays in this process. Despite the fact that the household appears to be the most important environment where children’s views, attitudes and capabilities are formed, we know little about how this environment relates to individual

¹According to (UNICEF, 2006), domestic violence or intimate partner violence refers to a pattern of assaultive and coercive behaviors including physical, sexual and psychological attacks, as well as economic coercion used by adults or adolescents against their current or former intimate partners. Examples of physical abuse include slapping, shaking, beating with a fist or object, strangulation, burning, kicking and threats with a knife. Sexual abuse includes coerced sex through threats or intimidation or through physical force, forcing unwanted sexual acts, forcing sex in front of others and forcing sex with others. Psychological abuse involves isolation from others, excessive jealousy, control of his or her activities, verbal aggression, intimidation through destruction of property, harassment or stalking, threats of violence and constant belittling and humiliation.

preferences. This vacuum is especially surprising given that it is known that early experiences are crucial for the development of the child (Cirulli, Berry, and Alleva, 2003; Davidson and McEwen, 2012; Gunnar and Quevedo, 2007; Huttenlocher, 1979; Thompson and Nelson, 2001) and that traumatic events experienced as an adult can affect the risk attitudes of adults (Callen, Isaqzadeh, Long, and Sprenger, 2014; Eckel, el Gamal, and Wilson, 2009; Malmendier and Nagel, 2011; Voors, Nillesen, Verwimp, Bulte, Lensink, and van Soest, 2012). There is evidence that children’s preferences differ by race and gender (Bettinger and Slonim, 2007; Cardenas, Dreber, von Essen, and Ranehill, 2012; Castillo et al., 2011; Gneezy and Rustichini, 2004; Levin and Hart, 2003), yet it is an open question whether early experiences affect preferences as well. Living in a household with domestic violence is a natural starting point to investigate the relation between household environment and risk or economic preferences because of the large body of research showing its negative effect on children’s development.

This paper takes advantage of a unique longitudinal study of a random sample of 1,900 Peruvian children whose households were surveyed when they were one, five, eight and twelve years old.² In the third visit, the children’s risk attitudes were measured by their selection of one of six possible lotteries that increased in mean and variance and included a sure payment option.³ The experiment has many desirable characteristics: it used standardized procedures, children made decisions without parental supervision, and they were paid in tokens that were redeemable in stickers of the child’s choosing. Harbaugh, Krause, and Vesterlund (2002); Levin and Hart (2003); Moreira, Matsushita, and da Silva (2010); Schlottmann (2001); Weller, Levin, and Denburg (2011) show that children not only can handle these types of questions, but also that preferences can be elicited in this way. The present study investigates how the choices in this experiment relate to measures of domestic violence experienced by mothers within the household.

Measurement problems and endogeneity typically make it difficult to determine how parents’ decisions affect the development of children. The evaluation of the effect of households with domestic violence on children’s preferences is no exception.⁴ To deal with measurement problems, I follow Heckman et al. (2013) to establish a measurement system to measure domestic violence, parental investments and the child’s cognitive and non-cognitive devel-

²The panel is part of the Young Lives study on childhood poverty (<http://www.younglives.org.uk/>). The panel also include a survey when the children were 12 years of age.

³The study did not collect information on time preferences.

⁴I construct measures of domestic violence based on reports by the child’s mother as well as reports of seeking assistance to deal with this problems. While mothers’ self-reports of domestic violence might be biased (Aizer, 2010; Ellsberg, Heise, Pena, Agurto, and Winkvist, 2001), they have the advantage of including events that the child was too young to remember and events that children less affected by the events might likely forget. According to these measures, 16.7% of the households in the sample reported domestic violence at least once and 3.3% reported it at least twice.

opment. This is possible due to the availability of a rich set of measures in the sample at hand. To deal with the potential endogeneity of the household environment and parental investment, I build on Cunha, Heckman, and Schennach (2010) and Aizer (2010) to develop a model where parental investment and domestic violence are the outcome of intra-household bargaining. The model predicts that if domestic violence is a private good that produces externalities on the mother and is consumed by fathers, then improvements in the gender wage gap should diminish the incidence of domestic violence in the household. I do confirm that the incidence of domestic violence decreases as the gender wage gap decreases.

The main finding of the paper is that the existence of domestic violence in the household is positively associated with risk aversion in children. The lower bound of the estimate is $-0.15SD$ decrease on the average lottery choice. I also find that the measure of domestic violence is associated with a significant decrease in the cognitive development of the child. The lower bound of the effect is $-0.3SD$ of the measure of cognitive development. To increase confidence in the results, I explore if these negative effects manifest in other outcomes as well. Children in households with domestic violence are less physically active, spend less time playing and have higher BMIs. This pattern is also present in the survey taken 4 years after the experiment as well. Increased risk aversion and inactivity point to domestic violence leading to internalizing behaviors. It is important to remark that acknowledging the measurement and endogeneity problems reveals a potential large underestimation of the effect of domestic violence on children's development and behavior. This is consistent with the existence of compensatory behaviors in the household and with domestic violence being equivalent to the absence of parental investment.

The emerging picture is that an important component of parenting is to provide children with a safe environment. To my knowledge, this is the first paper to show that parents can affect their children preferences and behavior, albeit they might do it unintentionally. An important open question is whether risk aversion is a maladaptive response to domestic violence. For instance, an increase in risk aversion might be accompanied by a reduction in the willingness to compete. If so, the potential economic cost of domestic violence might include not only the loss in potential human capital accumulation but also the opportunity cost of not choosing more advantageous but perhaps riskier options. While this might keep a child out of trouble, it might also prevent him/her from acquiring social skills. These are skills that are useful in the job market as well as in life in general. Similarly, if learning requires taking risks, exposure to domestic violence might have additional costs by discouraging experimentation. This study shows a negative impact on behavior and abilities.

The fact that preferences respond to personal experience sheds light on why a weak

relationship between individual characteristics and risk preferences has been identified with field data (von Gaudecker, van Soest, and Wengstrom, 2011). If economic preferences provide a summary statistic of life experiences, economic experiments might be a practical way to capture important information that other methods fail to acquire. This information is crucial to understand individual decisions, detect behavioral problems and to evaluate and design policy.

The analysis shows that there might ways to mitigate the prevalence of domestic violence, such as through the improvement of women’s labor prospects (Aizer, 2010). Some of the available interventions might be less costly than others. For instance, there is evidence that information campaigns are effective in deterring violence against women (see Ellsberg, Arango, Morton, Gennari, Kiplesund, Contreras, and Watts (2014); Pronyk, Hargreaves, Kim, Morison, Phetla, Watts, Busza, and Porter (2006)). Given the potential long-term effect of domestic violence on abilities and preferences, additional research on cost effective ways to prevent domestic violence is needed.

The paper is organized as follows. Section 2 provides background literature. Section 3 presents a simple intra-household model with parental investments in child development and domestic violence. Section 4 describe the estimation procedures and assumptions. Section 5 describes the sample and measures used in the analysis. Section 6 describes the results. Section 7 concludes.

2 Background literature

There is a large body of animal and human research showing that early life experiences have long-term impacts on cognition and behavior. For instance, children exposed to stress and emotional deprivation experience changes in the nervous, endocrine and immune systems (Brown et al., 2009; Danese and McEwen, 2012; Danese, Pariante, Caspi, Taylor, and Poulton, 2007; Felitti et al., 1998; Gunnar and Quevedo, 2007). Research also shows that children living in household with domestic violence can exhibit behavioral changes such as internalizing and externalizing behaviors (Emery, 2011; Fantuzzo and Mohr, 1999; Kernic et al., 2003; Osofsky, 1999) and impaired cognitive development (Koenen et al., 2003), thereby potentially worsening economic outcomes in life (Gertler et al., 2013; Heckman et al., 2013, 2006). A mother’s depression, which is strongly associated with domestic violence, can have similar effects because it has been found to affect the quality of the relationship with the child (Murray and Cooper, 1997; Tomlinson, Cooper, and Murray, 2005). Moreover, there is evidence from non-human species (e.g. rats and primates) that maternal care affects fearfulness in rats (Caldji, Tannenbaum, Sharma, Francis, Plotsky,

and Meaney, 1998) and that naturally occurring variations in maternal care can alter the expression of genes that regulate behavioral and endocrine responses to stress (Francis, Diorio, Plotsky, and Meaney, 2002; Meaney, 2001). There is also evidence that these effects are causal (Meaney, Aitken, Bodnoff, Iny, Tatarewicz, and Sapolsky, 2013) and that early adverse conditions can be diminished with improved care (Chisholm, Carter, Ames, and Morison, 1995; Gertler et al., 2013; Nelson, Zeanah, Fox, Marshall, Smyke, and Guthrie, 2007).

This literature suggests at least two channels through which exposure to domestic violence might affect risk preferences. The first channel is through its effect on cognitive development. Studies with adults show a consistent negative relationship between cognitive ability and risk aversion (Burks, Carpenter, Goette, and Rustichini, 2009; Dohmen, Falk, Huffman, and Sunde, 2010). More risk aversion is therefore expected among children exposed to domestic violence if the relationship between cognitive ability and preferences appears in early childhood. A second potential channel through which domestic violence might affect risk preferences is by its effect on stress. For instance, (Chen, Cohen, and Miller, 2010) observed that the positive relationship between lower socioeconomic status and higher levels of cortisol among children was partially mediated by their perceptions of threat and by family chaos. Bair-Merritt, Johnson, Okelo, and Page (2012) show that children exposed to intimate partner violence present elevated levels of cortisol. Finally, Korte (2001) discusses how the hormonal system regulating fear and anxiety can become maladaptive when it is chronically unbalanced due to stress. This is likely to occur in the face of prolonged stress and is important because recent evidence (Kandasamy, Hardy, Page, Schaffner, Graggaber, Powlson, Fletcher, Gurnell, and Coates, 2014) shows that an experimentally induced elevation of cortisol levels over a period of 8 days causes subjects to behave more risk aversely.⁵ If children exposed to domestic violence have elevated levels of cortisol due to stress, we should expect them to behave more risk aversely.⁶ Importantly, absent an increase in the base level of cortisol, threat of violence might itself affect behavior. Haushofer and Fehr (2014) show that risk aversion can be induced by the threat of receiving random levels of high or low electrical shocks. The threat of electrical shocks is a way to experimentally induce fear and stress. Finally, Harrison, List, and Towe (2007) also show that background risk can increase risk aversion.

This suggests that children facing exposed to domestic violence might behave more risk

⁵This effect was found to be larger among men.

⁶Gunnar and Quevedo (2007) shows that prolonged exposure to stress can lead to *lower* levels of cortisol (hypocortisolism). However, this condition is associated with a lower responsiveness to incentives. Evidence of this effect in children can be found in Ouellet-Morin, Danese, Bowes, Shakoor, Ambler, Pariente, Papadopoulos, Caspi, Moffitt, and Arseneault (2011).

aversely because they experience more stress and/or more uncertainty. The collected data do not include measures of stress, however, the prevailing evidence suggests this could be an underlying mechanism for the observed risk averse behavior.

3 Theoretical framework

I discuss a simple model of intra-household bargaining with children where domestic violence between husband and wife and parental investment in the child's cognitive development are endogenous variables. In this model the husband's and wife's outside options determine the bargaining outcome. Violent behavior by a husband is treated as a private good whose consumption produces a negative externality on both the wife and the child. Domestic violence plays the role of a harmful habit like smoking. In the model, the more the parents care about their child's cognitive development the more they will curtail domestic violence. If husband's and wife's market wages determine their outside options, these wages will also determine the level of violence in the household. Similarly, any increase in the cost of being violent, like an increase in police protection of women, will also decrease violence.

The remainder of the section discusses the model more formally.

Let $(C_{0,m}, C_{0,f})$ be the husband's (m for male) and wife's (f for female) consumption in period 0. Let I_0 be investment in the development of the child in period 0. The level of violence exercised by the husband on the wife is V_0 , and the associated externality experienced by the wife, her level of safety, S_0 , is $S_0 = \bar{V} - V_0$. Here, \bar{V} is the maximum level of violence the person can withstand. The husband's and the wife's earnings in period 0 are $Y_{0,m}$ and $Y_{0,f}$. Finally, the cognitive development of the child in period 0 and period 1 are denoted by θ_0 and θ_1 and the mother's human capital is θ_M .⁷ I model the household decisions as a Nash bargaining problem. In particular,

$$\max_{C_{0,m}, C_{0,f}, V_0, I_0} [a_1 u(C_{0,m}) + a_2 u(V_0) + a_3 u(\theta_1) - \omega_m]^\gamma \times [b_1 v(C_{0,f}) + b_2 v(S_0) + b_3 v(\theta_1) - \omega_f]^{1-\gamma}$$

subject to:

$$C_{0,m} + C_{0,f} + pI_0 \leq Y_{0,m} + Y_{0,f},$$

$$V_0 \leq \bar{V},$$

$$\theta_1 = f(\theta_0, I_0, \theta_M) e^{-\psi V_0}, \psi > 0, f \text{ is concave}$$

Where u and v are strictly concave and differentiable functions satisfying Inada's condition. The parameter γ represents the bargaining weight put on the husband's utility and

⁷Father's human capital is important as well, but measures of it are less frequent than those of the mother.

the variables ω_m and ω_f represent the wages that a husband and a wife would receive if they separated. The model makes two simplifying assumptions. First, the preferences of the husband and the wife are assumed to be separable in consumption, violence and the child's period one cognitive development. Second, the model ignores the intra-household bargaining that takes place in period one. This is done for convenience and clarity. A model that allows for dynamic intra-household bargaining as in (Ligon, 1998; Ligon, Thomas, and Worrall, 2002) would be significantly more complicated. The one-period model, however, is rich enough to give important insights on the interaction between parental investments and domestic violence.

The first order conditions associated with the interior solution of the problem are as follows:

1. $\frac{\gamma a_1 u'(C_{0,m})}{u_m(C_{0,m}, V_0, \theta_1) - \omega_m} = \lambda$
2. $\frac{(1-\gamma) b_1 v'(C_{0,f})}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f} = \lambda$
3. $\frac{\gamma a_2 u'(V_0)}{u_m(C_{0,m}, V_0, \theta_1) - \omega_m} - \frac{(1-\gamma) b_2 v'(S_0)}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f} - \left[\frac{\gamma a_3 u'(\theta_1)}{u_m(C_{0,m}, V_0, \theta_1) - \omega_m} + \frac{(1-\gamma) b_3 v'(\theta_1)}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f} \right] \psi \theta_1 = 0$
4. $\left[\frac{\gamma a_3 u'(\theta_1)}{u_m(C_{0,m}, V_0, \theta_1) - \omega_m} + \frac{(1-\gamma) b_3 v'(\theta_1)}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f} \right] f_{I_0}(\theta_0, I_0, \theta_M) e^{-\psi V_0} = \lambda p$

To gain insight on these conditions, consider first the case in which production of child cognitive development, θ_1 , is absent. In this case, the optimal choice of consumption and domestic violence would satisfy the following two equations:

1. $\frac{a_1 u'(C_{0,m})}{b_1 u'(C_{0,f})} = \frac{1-\gamma}{\gamma} \frac{u_m(C_{0,m}, V_0, \theta_1) - \omega_m}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f}$
2. $\frac{a_2 u'(V_0)}{b_2 v'(S_0)} = \frac{1-\gamma}{\gamma} \frac{u_m(C_{0,m}, V_0, \theta_1) - \omega_m}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f}$

These equations show that an improvement in the wife's outside option (higher ω_f) will be associated with an increase in the wife's consumption and a reduction in domestic violence. Evidence of these effects have been provided by Aizer (2010) using data from California.

To see the effect that the child cognitive production function has on the model, we need to look at the third first-order condition. The condition adds the negative term $-\left[\frac{\gamma a_3 u'(\theta_1)}{u_m(C_{0,m}, V_0, \theta_1) - \omega_m} + \frac{(1-\gamma) b_3 v'(\theta_1)}{u_f(C_{0,f}, S_0, \theta_1) - \omega_f} \right] \psi \theta_1$. This implies that in household with parents deriving utility from the cognitive development of their children the level of violence should be smaller than in households where parents do not care for the cognitive development of their children. Importantly, the expression also implies that the larger the negative effect of domestic violence has on the cognitive development of the child (ψ) the lower the

level of domestic violence should be. Similarly, the expression suggests a feedback effect from cognitive development to levels of domestic violence. Households with children with higher cognitive development (larger θ_0) will experience less domestic violence. This insight is important because it shows that a negative relationship between domestic violence and cognitive development might be driven by cognitive development and not vice versa. Finally, note that the fourth first order condition implies that parental investment will be negatively affected by the cost of such investments.

In sum, the model suggests that the costs of parental investments and husband's and wife's outside options should affect investments in the child's development and levels of domestic violence. The model also suggests that if domestic violence has a negative effect on the development of the child and the parents care about such development then domestic violence should be inversely related to past cognitive development. It is important to remark that this model does not model the formation of the child's economic preferences and it assumes that parents do not change their behavior to influence these preferences. Any effect that either parental investment and domestic violence have on the child's preferences will be indirect.

4 Methods

Testing the empirical implications of the model presents several challenges. First, both parental investments and domestic violence are endogenous variables. Second, cognitive development, parental investments and domestic violence are not directly observable. In this section, I adapt the framework from Heckman et al. (2013) to extract latent variables from survey data.⁸

In this paper, I consider a simple linear approximation to the determination of cognitive abilities (θ_1) and risk preferences at age 8. In particular, I consider the following empirical model for outcome y_i^k of child i ,

$$y_{1,i}^k = \alpha_{I_0}^k I_{0,i} + \alpha_{V_0}^k V_{0,i} + \alpha_{\theta_0}^k \theta_{0,i} + \alpha_{\theta_M}^k \theta_{M,i} + X_i' \beta_i^k + \varepsilon_i^k \quad (1)$$

In this expression, X_i' represents a set of additional determinants of outcomes and ε_i^k represents factor affecting the child that are not observed by the researcher.

The empirical model above is limiting. The research on child development (Cunha et al., 2010) demonstrates that there are important complementarities between different inputs in the production of cognitive and non-cognitive abilities. I make these assumptions to make

⁸Attanasio, Meghir, and Nix (2015) have used a related approach using the Young Lives sample of India. In their study, they estimate a model of child development similar to that in Cunha et al. (2010). They consider parental investments in money and time.

the underlying assumption in the estimation as transparent and simple as possible. I will discuss the results of the estimations in light of these simplifying assumptions.

4.1 Measurement and Estimation

The model describe above has four main components: parental investments, mother’s human capital, domestic violence, cognitive development and risk attitudes. Except for risk attitudes, which are measured with an experiment, all the other variables are assumed to be measured with error. In other words, the estimation assumes that neither parental investments, mother’s human capital, domestic violence or cognitive development are directly observed, but that only variables imperfectly measuring them are observed. The assumption that risk attitudes are measured without error is made out of necessity. The panel data do not have alternative measures of either risk or other preferences. The fact that the results are consistently strong despite this shortcoming suggests that this assumption is not limiting. Table 2 shows the descriptive statistics of all the measures used in the estimations and the variables to which they are dedicated.

I follow Heckman et al. (2013) to develop a measurement system for the latent variables in the model. The approach shows how to use derived measures of the latent factor in regression analysis and how to correct these estimates to address the fact that latent factors are measured with error. The basic assumption of the model is the existence of measures $\hat{M}_{m_j}^j, m_j \in \mathcal{M}_j$ for each of the latent factors $j \in \mathcal{I}$. In this study, we use standardized measures and write the basic measurement equation as:

$$\hat{M}_{m_j}^j = \lambda_{m_j}^j \theta^j + \varepsilon_{m_j}^j, j \in \mathcal{I}, m_j \in \mathcal{M}_j \quad (2)$$

I further assume that latent variables are zero mean with covariance matrix Σ and that $COV(\varepsilon_{m_j}^j, \varepsilon_{m_k}^k) = 0$, all $j, k \in \mathcal{I}, m_j \in \mathcal{M}_j, m_k \in \mathcal{M}_k$. That is, I assume that measures noise terms are uncorrelated for all measures. Under the additional normalization assumption that $\lambda_1^j = 1$ for all $j \in \mathcal{I}$, Heckman et al. (2013) show that the measurement system can be identified from the covariances of measures if there are at least 3 measures per latent factor.⁹

The vector of measures for person i can be expressed as $M_i = \Lambda \theta_i + \varepsilon_i$, with $COV(\varepsilon_i, \varepsilon_i) = \Omega$ and ε_i independent of θ_i . An unbiased estimator of θ_i is:

$$\hat{\theta}_i = (\Lambda' \Omega^{-1} \Lambda)^{-1} \Lambda' \Omega^{-1} M_i \quad (3)$$

⁹In the absence of serial correlation, only two measures are needed. I identify the parameters of the cognitive development of a child at age 5 under this assumption due to the fact that in the second round of the study only two measures of cognitive development were available.

The estimates of θ_i cannot be used directly in estimations due to the fact that there are measured with error. In particular, let the equation of interest be:

$$Y_i = \alpha\theta_i + \gamma X_i + \varepsilon_i \quad (4)$$

with $E[\varepsilon_i] = 0$ and (θ_i, X_i) statistically independent of ε_i . Let $\theta_{S,i}$ denote the estimate of θ . Assuming that $\theta_{S,i} = \theta_i + V_i$, $E[V_i] = 0$ and (θ_i, X_i) statistically independent of V_i , the linear regression will produce biased estimates. In particular, Heckman et al. (2013) show that

$$plim \begin{pmatrix} \hat{\alpha} \\ \hat{\gamma} \end{pmatrix} = \begin{pmatrix} COV(\theta_S, \theta_S) & COV(\theta_S, X) \\ COV(X, \theta_S) & COV(X, X) \end{pmatrix}^{-1} \begin{pmatrix} COV(\theta, \theta) & COV(\theta, X) \\ COV(X, \theta) & COV(X, X) \end{pmatrix} \begin{pmatrix} \alpha \\ \gamma \end{pmatrix} \quad (5)$$

In the formulas above, the terms in $COV(\theta, \theta)$ can be obtained from the estimates of the measurement system. Unbiased estimates for the linear regression can be obtained by pre-multiplying the OLS estimates by the inverse of the bias term.

In this study, we have reasons to suspect that some of the latent variables are endogenous. This is the case for parental investment and domestic violence. Suppose that the equation of interest is now $Y_i = \alpha\theta_{i,1} + \gamma\theta_{i,2} + \varepsilon_i$ with $E[\varepsilon_i] = 0$ and $(\theta_{i,2}, Z_i)$ statistically independent of ε_i . In this context, Z_i is an instrumental variable for $\theta_{i,1}$. Using similar arguments, it can be shown that instrumental variables estimates will also be biased if some of the controls are latent variables measured with error. In particular, we have that

$$plim \begin{pmatrix} \hat{\alpha}_{IV} \\ \hat{\gamma}_{IV} \end{pmatrix} = \begin{pmatrix} COV(Z, \theta_{S,1}) & COV(Z, \theta_{S,2}) \\ COV(\theta_{S,2}, \theta_{S,1}) & COV(\theta_{S,2}, \theta_{S,2}) \end{pmatrix}^{-1} \begin{pmatrix} COV(Z, \theta_1) & COV(Z, \theta_2) \\ COV(\theta_2, \theta_1) & COV(\theta_2, \theta_2) \end{pmatrix} \begin{pmatrix} \alpha \\ \gamma \end{pmatrix} \quad (6)$$

As in the case of linear regression, the terms in the correction matrix can be obtained from the estimates of the measurement system. I will formulate that account for measurement error in the analysis that follows.

Another remaining potential challenge to the validity of this study is the presence of weak instruments. I will use the reduce form method recently proposed by Chernozhukov and Hansen (2008) to estimate the significance of both parental investment and domestic violence. The method is robust in the presence of weak instruments. The idea of this method is to construct confidence intervals of the coefficients of interest by testing the significance of the instruments on the residuals of the outcome equation under the hypothesis that the assumed coefficient is correct. So, for instance, if the true equation is $Y_i = \alpha X_i + \varepsilon_i$ and Z_i is a valid instrument, then $Y_i - \alpha X_i$ must be independent of Z_i . I will use this

approach to determine the significance of the parental investment and domestic violence. Since the method requires eliminating the influence of other covariates prior to performing the tests, this adjustments will be made using estimates that account for the possibility of measurement error as explained above. In particular, I will use the residuals of the regression of outcome Y_i , endogenous latent factor $\theta_{1,i}$ and instrument Z_i on variables $(\theta_{2,i}, X_i)$ whereby the estimates of these regressions account for the fact that latent variable $\theta_{2,i}$ is measured with error.

5 Sample selection and Data

This section discusses the sample and variables used in the empirical analysis.

5.1 Sample

The original sample included 2,052 children ages 6 to 18 months. The sample was selected in a series of steps. First, 1,818 districts were ranked according to the 2000 *Fondo Nacional de Compensacion y Desarrollo Social* (FONCODES, 2001) poverty index. The index aggregates information on infant mortality, housing, schooling, roads, and access to services. Districts ranked at the top 5% of the distribution were excluded from the sample to over-represent poor districts. Each of the remaining districts was subdivided in geographical areas of similar population and then 20 of these units were selected for the study. Each of these 20 units was further subdivided in census tracks and one track was selected at random in each unit. All the households in the selected track were visited to identify if the household had a child in the desired age range. Finally, neighboring census tracks were visited until completing 100 eligible households. (Escobal and Flores, 2008) have compared the current sample with the 2000 Demographic and Health Survey, the 2001 Living Standard Measurement Survey and the 2005 Population census. They find that the sample of children are slightly richer than these other samples. While there is no information regarding refusals to participate in the study, (Outes-Leon and Dercon, 2008) find that attrition between the first and second round of the study is small and mostly random. The households were visited in four waves: 2002, 2006, 2009 and 2012.

5.2 Experiment

In the third wave of the study (2009), children were asked to choose one out of 6 possible lotteries that paid in tokens depending on a coin flip. The lotteries increased the mean and variance of payoffs (Binswanger, 1980; Eckel and Grossman, 2008) and were simple enough for the children to understand. The lotteries were paid to promote truthful revelation of

preferences (Harbaugh et al., 2002) and the payments were made in tokens redeemable in stickers of the child's choosing. Only 24 children of a total of 1,943 interviewed in the third wave have missing data on the lottery task. Of these 24 children, only one is reported to have refused to answer the lottery question. The instrument the children faced is shown in Figure 1. The first option was a sure payment; then, to distinguish between risk neutral and risk taking subjects, the last option only increased the variance of the lottery but kept the expected payoff constant. Figure 2 shows the distribution of lottery decisions for boys and girls (panel a) and the distribution of lottery decisions by children with and without reports of domestic violence in the 3rd survey (panel b). Children in households reporting domestic violence in the 3rd survey behave markedly different than children in households where domestic violence is not reported.

5.3 Measures of exposure to domestic violence

The measure of domestic violence in the first wave of the survey is based on the mother's answer to the question: "When [your partner] gets drunk does he hit you?" This question was answered in the affirmative 6 percent of the time. In the second and third waves of the survey, the measure of domestic violence is based on the mother's answer to the question: "When [a family member] gets drunk does he/she turn aggressive?" This question was answered in the affirmative 8 and 7 percent of the time in the second and third waves of the survey. The wording in the second and third survey has the advantage of being more inclusive. This might explain why the prevalence of events of domestic violence is slightly larger in the latter surveys. For instance, none of the 162 mothers who were divorced or separated in the first survey reported an incident of domestic violence, but 5 out the 128 mothers who were divorced or separated in the second and third survey reported an incident of domestic violence. Information from the third survey suggests, however, that answers likely refer to the behavior of the mother's partner.¹⁰ According to the third wave of the survey, 12 percent of the adults in the household were grand or great-grand parents and 16.9% percent other adults (uncles/aunts, siblings, cousins, etc.). The percent of households ever reporting a case of domestic violence is 16.7% and the percent of households reporting cases at least 2 times is 3.3%. These numbers are comparable to those found in developed countries (Hedin and Janson, 2000; McFarlane, Parker, and Soeken, 1996). The third wave of the survey also asks if the mother ask for help due to domestic violence problems. Twelve and a half percent responded in the affirmative to this question. This variable will be used as an additional measure of domestic violence. Finally, we will also use the presence of smokers (other than the mother) as an additional indicator of the quality of the home

¹⁰Question about domestic violence are not available in the fourth wave of the survey.

environment.¹¹

According to the World Health Organization (WHO, 2013), women who have been physically or sexually abused by their partners are almost twice as likely to experience depression. I confirm a similar pattern in the data by comparing indicators of the mother's depression using a 20 Yes/No questionnaire developed by the World Health Organization (WHO, 1994) for this purpose. A mother is considered to be at risk of depression if she responds yes to at least 8 of these 20 questions. According to this measure, mothers reporting domestic violence were about twice as likely to show signs of depression than other mothers (50% v. 28%, p-value < 0.001 in the first survey and 24% v. 12%, p-value < 0.001 in the second survey).¹² The measure used in this paper reproduces previous results of the effect of domestic violence on mothers' depression. Importantly, the effect does not seem to be due to the existence of time-invariant omitted variables. A regression of the change in the index of depression on the change in the reports of domestic violence, the change in the wealth index, and the change in marital status shows that domestic violence is associated with a 12 percentage points increase (p-value = 0.002) in the likelihood of being depressed.

The total number of reports of instances of domestic violence is negatively correlated with the mother's years of education ($r = -0.09$, p-value < 0.001), wealth index ($r = -0.08$, p-value < 0.001), being a single mother during the first survey ($r = -0.06$, p-value = 0.004) and positively correlated with the number of children ($r = 0.09$, p-value = 0.001), the father's childhood experience of domestic violence ($r = 0.08$, p-value = 0.003), the mother's childhood experience of domestic violence ($r = 0.09$, p-value = 0.001), and the recent experience of a bad shock ($r = 0.06$, p-value = 0.009). Similar results are obtained using the disaggregated reports of instances of domestic violence.

5.4 Measures of cognitive development and controls

Five measures of cognitive development are available in the 2nd and 3rd wave of the study. Children were administered the Peabody Picture Vocabulary Test (PPVT) at 5 and 8 years of age. The test's main objective is to measure vocabulary acquisition from 2.5 years of age to adulthood and consists of giving a person a stimulus word to be match with a picture. The questions are increasing in the level of difficulty. There is evidence that the PPVT is strongly correlated with measures of intelligence (Campbell, Bell, and Keith, 2001). The average number of correct answers was 29.1 (s.d. 17.8) at 5 years of age and 46.7 (s.d. 13.5) at 8 years of age. Cueto and Leon (2012); Cueto, Leon, Guerrero, and Munoz (2009)

¹¹The correlation between the answer to the domestic violence and the answer to the question about asking for help is 0.146 (p-value < 0.001). The correlation with the number of smokers is 0.118 (p-value < 0.001).

¹²Answers to questions about depression are not available in the third survey.

provide detailed information on the validity of all tests for the current sample of children. For comparison, results on similar samples of children from India, Vietnam and Ethiopia are 27.4 (s.d. 21.1), 37.0 (s.d. 18.2) and 21.4 (s.d. 12.4) at age 5 and 49.2 (s.d. 26.7), 76.9 (s.d. 23.8) and 68.4 (s.d. 36.8) at age 8.

Children were also administered the Cognitive Development Assessment (CDA) developed by the International Evaluation Association. The test has three components: spatial relations, quantity and time, but only the quantity portion of the test was collected by the survey. The quantity portion of the test requires the child to indicate which picture of a set of pictures best represents a description given by the examiner. Notions such as a few, most, half, many, equal, etc. are evaluated by asking questions such as: ‘point to the plate that has a few cupcakes.’ This test was administered in the second survey and had on average 8.4 (s.d. 2.2) correct answers. For comparison, results on similar samples of children from India, Vietnam and Ethiopia are 9.4 (s.d. 2.6), 9.8 (s.d. 2.5) and 8.2 (s.d. 3.0).

Finally, math and reading tests were administered in the third wave of the study. The math test measures basic quantitative and number notions, including questions on counting, knowledge of numbers, number discrimination, and the use of basic operations. Questions were read by the field-worker with the aid of cards, so that no interference would result from poor reading skills. The second section of the test measures the ability to perform basic mathematics operations with numbers (addition, subtraction, multiplication and division). The average number of correct answers was 11.9 (s.d. 4.9) out of 29 questions. The reading test included writing and reading comprehension. The average number of correct answers was 7.7 (s.d. 3.0) out of 13 questions.

The pairwise correlations of the instruments are all significantly different from 0. The smallest is 0.379 between the cognitive test and math test. The largest is 0.657 between the two PPVT tests. The Cronbach scale reliability coefficient across all 5 measures is 0.6969. Factor analysis confirms this, the highest eigenvalue for all these measures is 3.042. Parallel analysis (Horn, 1965) suggest the existence of a sole common latent factor. In the analysis, I will construct two indices, one for cognitive development at 8 and one for cognitive development at 5.

To make the measures comparable across children, the effect of age, gender and location of the child at the time of measurement is removed using linear regressions. The measures of the mother’s human capital are years of schooling, the ability to read in her mother’s language and whether she is Spanish speaker (the dominant language of Peru). Household structure is approximated by household size and whether both parents live together. I also include a wealth index to control for the child’s socio-economic status. The index has been shown to be a good substitute, and sometimes a better alternative, to measures of household

consumption (Filmer and Pritchett, 1999, 2001). The index has three main components: housing quality, consumer durables and services. The index is calculated according to the information in the first survey and has a mean of 0.42 (s.d. 0.19, min 0.03, max 0.83).

Unfortunately, the surveys have only a handful of indicators of the child’s field behavior. All the surveys includes measures of the child’s BMI. These are based on measurements performed by the enumerators who were trained for the task. The enumerators used a scale to measure weight and a metric measuring stick for height. The latter surveys include the average time a day a child spends playing and studying.¹³ Finally, the third survey includes the mother’s answers to the following two questions: “During the last 7 days, on how many days was [Name] physically active for at least 60 minutes at one time? (Examples for physical activity would be running, biking, dancing, football, digging, carrying water, or other activities) 00 = 0 days, 01= 1 day, 02= 2 days 03= 3 days 04=4 days 05=5 days 06=6 days 07= 7 days (every day)” and “How much time does [Name] spend during a typical day sitting (school, work, watching TV and sitting with friends)? 01= Less than 1 hour per day, 02= 1 to 2 hours a day 03= 3 to 4 hours a day 04= 5 to 7 hours a day 05= more than 7 hours”. I use these variables to explore the robustness of the main results.

6 Results

This section presents the estimations on the relationship between domestic violence and risk aversion. The evidence suggests that being in a household where a mother reports experiencing domestic violence increases the level of risk aversion of the child. Estimates that do not account for endogeneity underestimate the negative effect of domestic violence.

6.1 Measurement

Table 1 presents basic descriptive statistics of sample and Table 2 presents information on the relation between the measurement variables and the latent factors they represent. Table 3 presents the information content of each measure of each of the latent variables. I confirm that, for this sample, measures of latent variables are noisy. The table shows that measures of cognitive development are more informative than those associated with parental investment and domestic violence and household environment. Explanatory factor analysis suggests that the current grouping of variables is appropriate. With the exception of parental investment, for which there is some evidence of a second latent variable, I find that at most a latent factor exists. The largest eigenvalue is 2.25 (second largest 0.40)

¹³The actual wording of the question is: “Now, think about the rest of NAMEs day. I want you to tell me how much time NAME spent on the following activities during a typical day?”

for the measures of cognitive development at 8, 2.11 (second largest 0.49) for cognitive development at 12, 1.56 (second largest 1.17) for parental investment, 1.35 (second largest 0.96) for domestic violence, 1.47 (second largest 0.53) for cognitive development at 5, and 1.98 (second largest 0.59) for mother’s capital.¹⁴

6.2 Preliminary results

Table 4 presents the correlation coefficients between the lottery decision, indices of the mother’s psychological malaise¹⁵ and an indicator variable that equals 1 if the child had a serious injury (e.g. burns, broken bones, etc.). The decision in the risk experiment is correlated with the gender of the child, reports of domestic violence in the 2nd and 3rd surveys and the manner in which mothers react to misbehavior by the child. Reasoning with the child is negatively correlated with taking risks in the experiment and using corporal punishment is positively correlated with taking risks in the experiment. The mother’s psychological malaise is positively correlated with reports of domestic violence. This is also positively correlated with a child’s injuries and cognitive development at age 5. This is consistent with the mother’s wellbeing being important in providing effective care for the child. Finally, mothers with higher indices of psychological malaise are more likely to report asking for help on issues related to domestic and child abuse in the third survey of the panel.

Table 5 presents fixed-effect regressions of the mother’s psychological malaise index, the child’s serious injuries and cognitive development on reports of domestic violence made by the mothers. These regressions can be implemented due to the fact that there are repeated measures of some of these variables. We observe that reports of domestic violence are positively correlated with the mother’s psychological malaise and negatively correlated with measures of the child’s cognitive development. Domestic violence is not correlated with a child’s serious injuries, but serious injuries are positively correlated with the mother’s psychological malaise. These estimates show that the relationship between domestic violence and the mother’s wellbeing and the child’s development are not due to omitted time-invariant variables. These regressions do not address the problem of endogeneity. For instance, the health of the mother and a lower than expected cognitive development of the child might trigger domestic violence. The next section presents results that address the issue of endogeneity.

¹⁴This calculations are performed after the effect of age, sex and location has been removed from each of the measures.

¹⁵The indices are the common factor of the 20-item signs of depression questionnaire for the 1st, 2nd and 4th survey and the life satisfaction questionnaire for the 3rd survey.

6.3 Coefficient estimates

All the tables presented in this section share a common structure. First, due to the fact that the measures of latent factors are likely measured with error, the coefficient estimates use the formulas presented in the Methods section to account for it. Second, due to the fact that all the regressions use constructed variables, the 90 percent confidence interval of each regression coefficient is obtained using 1000 bootstrap replications. Finally, all the regressions include the household wealth index, family size and whether both parents live in the household.¹⁶ This is done to control for pre-existent differences across households. It is also assumed that the instrumental variables are valid conditional on these variables.

Table 6 presents linear regressions estimates of the effect of parental investment and domestic violence on all the outcome variables. This estimates are not reliable due to the endogeneity of both parental investments and domestic violence. In particular, it can be argued that these estimates under-estimate the effect of both variables. For instance, parents might engage in compensatory behavior if they observe a child experience a negative shock. If a parent invests more to compensate a negative shock, it would be more likely to observe a weaker or negative relationship between say cognitive development and parental investment.¹⁷ If domestic violence is a kind of negative parental investment, a similar pattern would emerge.

The coefficient estimates in Table 6 show a relationship between the measure of parental investment and cognitive development at 8 years of age with the child's BMI and time studying at 8 years of age and 12 years of age. The results also show a relationship between the measure of domestic violence and risk aversion. The relationship between domestic violence and risk aversion can also be seen with indicators variables constructed from the responses in the lottery experiment.

The theory section suggests that, conditional on wealth and family structure, current income and relative wages should influence parental investment and domestic violence. Income affects the availability of resources the parents have to invest in their children and relative wages affect the bargaining power of mothers affecting the equilibrium level of domestic violence in the household. In the analysis that follows, I use the reported income in the third wave of the survey because only in this wave of the study complete data on income was collected. Previous waves of the study have very incomplete records on income. Regarding wages, I rely on a national representative sample of Peruvian households (ENAHO) to calculate the market wages of men and women. The Peruvian National Household Survey

¹⁶As mentioned before the effect of sex, age and location are factor out prior to conducting estimations.

¹⁷Attanasio et al. (2015) present evidence of underestimation of the effect of parental investment due to endogeneity using the Young Lives sample from India.

(ENAH) collects information from a random sample of 2,200 households every month in order to assess living standards. The 2009 sample used in this paper included 26,988 household and 17,285 individual observations on wages.¹⁸ To diminish the possibility that some local characteristics influence local wages, I use the average of neighboring province in the calculation of both men and women wages. This reduces the chances that local prevailing levels of violence against women manifest themselves as lower wages due to productivity losses.

Table 7 shows the effect of household income and the gender wage gap on parental investment, domestic violence and all the outcome variables.¹⁹ The first observation is that the theoretically motivated instruments are relevant. Current income positively affects parental investment controlling for wealth and household characteristics and the gender wage gap (women's wage - men's wage) is negatively associated with domestic violence. Table 7 also shows that cognitive development is self-productive as previously found in the literature (Cunha et al., 2010). However, while negative, the relationship between past child cognitive development is not significantly correlated with domestic violence. Finally, the measure of wealth is significantly positively correlated with cognitive development and negatively correlated with domestic violence.

Table 7 shows a consistent relationship between the gender wage gap and several of the outcome variables. It is positively correlated with cognitive development, risk taking behavior, physical activity and time playing. It is negatively correlated with the child BMI and time of the day sitting. By construction, this result is robust to measurement and sampling error. Current income has a consistent positive effect on the child's BMI.

The current results do not reveal the potential mechanisms through which income and increased bargaining position affect the child's outcomes. For instance, a mother's improved bargaining position might increase parental investment if she cares relatively more for the child's outcomes than the father (Duflo, 2003). I address this issue by estimating the effect of both parental investment and domestic violence by instrumental variable methods.

Table 8 presents the instrumental variable estimation of the effect of parental investment and domestic violence on the child's outcomes. While the formulas used in Table 8 account for the measurement error of latent factors (past cognitive development and mother's capital) they might produce biased estimates due to the presence of weak instruments. Note that the relationship between domestic violence and outcomes is the reciprocal of the effect

¹⁸The community survey corresponding to the Young Lives study contain some information on wages. This information is collected from informants and it is selective and incomplete.

¹⁹This relationship holds with alternative specifications and additional instruments. The current, minimal, specification makes the interpretation easier and helps avoid potential problems associated with the use of multiple weak instruments.

of the gender wage gap on the same outcomes. While the confidence intervals show that these estimates are noisier than those in Table 7, these results are consistent with domestic violence being a mediating variable. Parental investments are significant for the indicator variable for a lottery choice not equal to the safest one and for cognitive development at age 12. It would be important to know whether domestic violence and parental investments around age 12 affect cognitive development at age 12 conditional on cognitive development at age 8. Unfortunately, questions about domestic violence are not available for the 4th wave of the survey. The current specification of the model reflects the limitations of the data available.

The estimates using standard instrumental variables might be biased due to the presence of weak instruments. It would then be important to assess the significance of domestic violence using a method that is robust to this problem. I use Chernozhukov and Hansen (2008) approach for this purpose. In particular, I can test the joint hypothesis that domestic violence and parental investment are significant by conducting a Wald test on the significance of the instruments on the reduced form. Table 8 shows the magnitude and significance of the test for all the regressions. The test shows that domestic violence and parental investment are jointly significant in the outcomes already identified in the reduced form regressions (Table 7). Table 8 also provides the minimum value of the coefficient on domestic violence using the grid search method proposed by Chernozhukov and Hansen (2008).

Regarding the size of the effect, only domestic violence has effects that are unconditionally different from zero. The measure of parental investment used here is never unconditionally different from 0. The lower bound of the effect of domestic violence is large for cognitive development (-0.3SD) and lottery choices (-0.15SD). The effects are large for BMI ($\geq 1SD$) as well. Finally, Table 8 reports the percent of the bootstrap replications in which the Wald test for the null hypothesis that neither parental investment nor domestic violence was not rejected. This gives a measure of the robustness of the results so far presented. Cognitive development, lottery choices, BMI and time use remain significant in more than 90 percent of the replications in some of the specifications (e.g. choice of the riskiest lottery choice). This exercise also shows the sensitivity of the results to sampling error.

Table 9 and Table 10 present estimates of the model excluding parental investment and domestic violence respectively. The estimates confirm the result that domestic violence has a significant effect in a series of outcomes and the measure of parental investment does not. The estimates also confirm that estimates of the significance of the effect on some of the outcomes are sensitive to sampling error.

In sum, these results show a strong correlation between the measure of domestic violence

and cognitive development, risk aversion, BMI and play both contemporaneously and four years after risk preferences were measured. Contrary to previous research, however, we do not find a correlation between the measure of parental investment and these outcomes. This might be due to the lack of better indicators of parental investment than those available in developed countries samples. Indeed, Table 3 shows that some of the measures of parental involvement are weakly correlated with the latent variable. Another reason might be that in developing countries environmental variables are more important than monetary investments due to the lack of a highly differentiated educational system.²⁰ We observe, however, that the wealth index is strongly and positively correlated with cognitive development and the amount of time children spend studying. It is possible that, on the margin, parental monetary investments are less effective given wealth. While the measure of parental investment likely covers behaviors prior to the time the survey was taken, it might be that prior parental investments are the ones to take into consideration. The Appendix presents estimates of the model using a measure of parental investment based on the second survey only. The tables in the Appendix show that the similar results are obtained using this alternative specification.²¹

7 Conclusions

Using a longitudinal study of a random sample of Peruvian children, I investigate the relationship between the presence of domestic violence in the household in early childhood and the cognitive development and risk attitudes of children. My results confirm previous research that cognitive development is negatively affected by domestic violence and that this effect is unlikely due to omitted variables. I also find that domestic violence is associated with more risk averse behavior. While domestic violence affects cognitive development and risk attitudes separately, these last two variables are themselves not correlated. Bad early experiences, such as living in a household with domestic violence, can have multiple and separate effects.

It is in general difficult to establish causality between domestic violence and children's risk attitudes. I extend the model of child development proposed by Cunha et al. (2010) to include the presence of domestic violence and intra-household bargaining. The estimates show that domestic violence negatively affects the cognitive development of children and their propensity to take risks. The results are robust to endogeneity and measurement

²⁰For instance, the cultural and knowledge offer available in developed countries is vastly larger than those available in Peru. A parent might have fewer ways to offer their children an stimulating environment.

²¹The results in the Appendix must be taken with caution since neither measures of parental investment and income are as complete as in subsequent surveys.

problems.

Some research shows that exposure to domestic violence during childhood increases the likelihood of committing crimes and engaging in risky activities (Carrell and Hoekstra, 2010; Currie and Tekin, 2006). I find instead that children growing up in households experiencing domestic violence are more risk averse. This apparent contradiction might be due to the fact that children exposed to domestic violence are also more likely to have higher costs to human capital accumulation, by its effect on cognitive abilities and household dynamics, and this could drive crime and risky behavior (Freeman, 1999). The results of this paper combined with previous results highlight the complementarity between experimental and survey methods in the identification of the reasons why past experiences affect future behavior.

There is recent evidence showing that interventions during infancy can produce behavioral changes later in life (Gertler et al., 2013; Heckman et al., 2013). This paper shows that individual preferences themselves might be altered as well. Policies aimed at improving the child's condition in the household might be a necessary complement for the success of interventions at the school level.

8 References

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Figure 1: Lottery Instrument

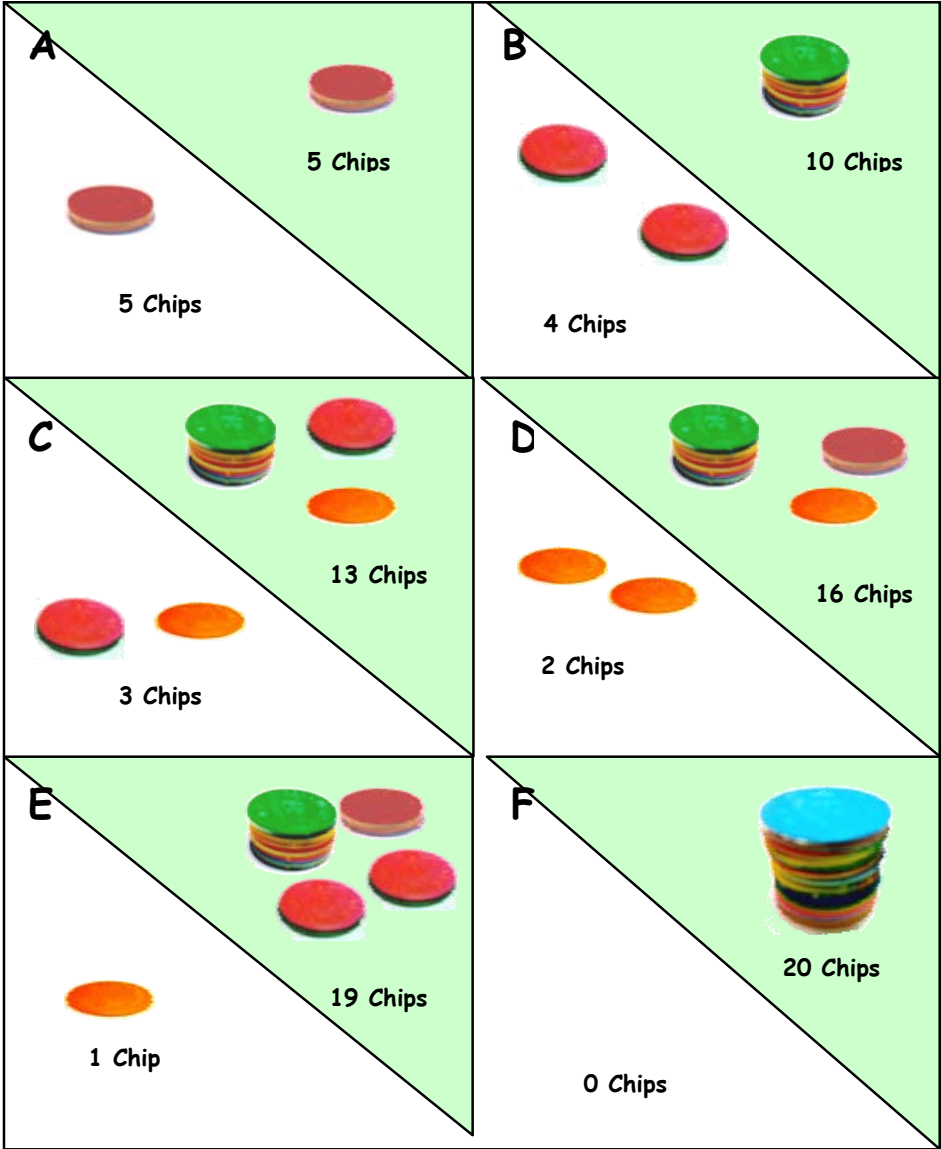
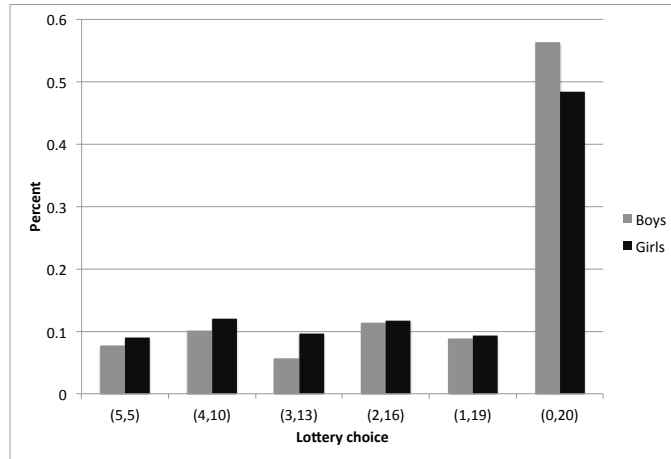
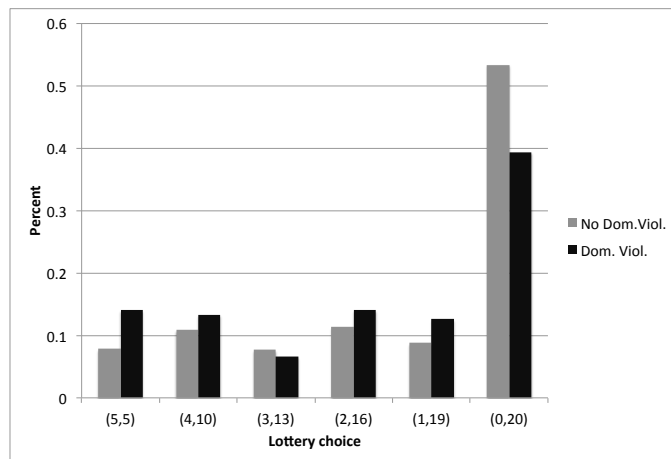


Figure 2: Distribution of lottery choices



(a) Gender



(b) Domestic violence (3rd survey)

Table 1: DESCRIPTIVE STATISTICS OF COVARIATES AND OUTCOMES

	N	Mean	S.D.
Wealth index (3rd wave)	1919	0.54	0.21
Household income (3rd wave)	1919	11126.2	21728.9
Female average wage (2009)	1919	560.5	80.2
Male average wage (2009)	1919	748.5	130.6
Household size	1919	5.7	2.3
Two-parent household	1919	86.9	33.8
Lottery choice (1=safest, 6=riskiest)	1919	4.6	1.8
Child's BMI (3rd wave)	1915	16.9	2.3
Child's BMI (4th wave)	1843	19.6	3.3
Hours in a typical day sitting	1897	4.2	0.8
Days being active at least 60 minutes (3rd wave)	1907	3.6	2.7
Hours a day playing (3rd wave)	1913	4.2	1.7
Hours a day studying (3rd wave)	1912	1.9	0.8
Hours a day playing (4th wave)	1859	3.7	1.4
Hours a day studying (4th wave)	1859	1.8	0.9

Note: 1st wave in 2002 was completed when the child was between 6 and 18 months old. Second wave was in 2006, 3rd wave in 2009, 4th in 2012.

Table 2: DESCRIPTIVE STATISTICS OF MEASURE VARIABLES FOR 8 YEAR OLD SAMPLE

	N	Mean	S.D.
COGNITIVE DEVELOPMENT AT AGE 5			
Peabody test (2nd wave)	1845	29.2	17.9
Cognitive test (2nd wave)	1888	8.4	2.1
COGNITIVE DEVELOPMENT AT AGE 8			
Peabody test (3rd wave)	1836	46.8	13.5
Math test (3rd wave)	1882	11.9	4.9
Reading & writing test (3rd wave)	1739	7.7	3.0
COGNITIVE DEVELOPMENT AT AGE 12			
Peabody test (4th wave)	1875	85.6	17.5
Math test (4th wave)	1871	16.1	5.5
Reading & writing test (4th wave)	1871	14.4	3.6
PARENTAL INVESTMENT			
Expenditure on child (3rd wave)	1912	553.5	1365.2
Value of gifts to child (3rd wave)	1912	342.7	497.7
Number of books at home	1915	1.7	1.3
Helps child with homework	1919	61.7	48.6
Encourages child to read	1915	2.5	0.6
Knows the name of child's friends	1912	84.1	36.6
Reason with child when misbehaves	1913	45.1	32.4
MOTHER'S CAPITAL			
Mother's years of schooling	1909	31.3	9.1
Spanish speaker	1919	85.2	35.5
Mother's ability to read in first language (0=not at all, 1=w/diffic.,3=w/ease)	1919	1.6	0.7
DOMESTIC VIOLENCE			
Reported domestic violence in 3rd wave	1919	7.0	25.6
Reported domestic violence in 2nd wave	1919	8.2	27.4
Ask for help due to Dom. Viol. (3rd wave)	1919	12.5	33.0
Number of smokers (excl. mother)	1905	0.1	0.4

Table 3: MEASUREMENT SYSTEM

	PROPORTION OF THE VARI- ANCE EXPLAINED BY LATENT VARIABLE
Cognitive ability at 12 (4th round)	
Peabody test (4th survey)	0.478
Math knowledge exam	0.549
Early grade reading assessment	0.645
Cognitive ability at 8 (3rd round)	
Peabody test (3rd survey)	0.534
Math knowledge exam	0.556
Early grade reading assessment	0.645
Parental investments	
Monetary expenses on child	0.230
Gifts	0.288
No. books at home	0.124
Helps child w/homework	0.007
Encourages child to read	0.006
No. names of child's friends known	0.013
Reasons with child when misbehaves	0.009
Domestic violence/Household environment	
Reported DV in 3rd survey	0.386
Reported DV in 2nd survey	0.108
Searched for help (3rd survey)	0.044
No. people who smoke in the house	0.094
Cognitive ability at 5 (2nd round)	
Peabody test (2nd survey)	0.238
Cognitive test	0.867
Mother's capital	
Years of schooling	0.436
Spanish speaker	0.388
Mother can read in first language learned	0.684

Note: Measures control for age, location and sex of child at the time of data collection. All variables are standardized.

Table 4: Correlation table

Variables	Lottery decision						Mother's psych. malaise						Child serious injuries						
	y_1	y_2	y_3	y_4	y_5	y_6	Wave 1	Wave 2	Wave 3	Wave 4	Wave 1	Wave 2	Wave 3	Wave 4	Wave 1	Wave 2	Wave 3	Wave 4	
y_1	1.000																		
y_2	0.629*** (0.000)	1.000																	
y_3	0.847*** (0.000)	0.628*** (0.000)	1.000																
y_4	0.905*** (0.000)	0.512*** (0.000)	0.816*** (0.000)	1.000															
y_5	0.902*** (0.000)	0.394*** (0.000)	0.627*** (0.000)	0.769*** (0.000)	1.000														
y_6	0.833*** (0.000)	0.323*** (0.000)	0.515*** (0.000)	0.631*** (0.000)	0.821*** (0.000)	1.000													
Mother's psych. malaise index (wave 1)	0.015 (0.559)	-0.003 (0.892)	-0.016 (0.530)	0.019 (0.458)	0.028 (0.271)	0.024 (0.359)	1.000												
Mother's psych. malaise index (wave 2)	-0.025 (0.336)	-0.041 (0.111)	-0.014 (0.599)	-0.012 (0.629)	-0.017 (0.508)	-0.026 (0.309)	0.288*** (0.000)	1.000											
Mother's psych. malaise index (wave 3)	0.004 (0.873)	-0.024 (0.347)	-0.006 (0.825)	0.017 (0.506)	0.006 (0.821)	0.012 (0.643)	0.169*** (0.000)	0.166*** (0.000)	1.000										
Mother's psych. malaise index (wave 4)	0.011 (0.672)	0.021 (0.418)	0.014 (0.580)	0.008 (0.764)	0.013 (0.626)	-0.004 (0.891)	0.346*** (0.000)	0.257*** (0.000)	0.224*** (0.000)	1.000									
Serious injury (wave 1)	-0.047* (0.070)	-0.042* (0.099)	-0.039 (0.129)	-0.026 (0.304)	-0.030 (0.243)	-0.057** (0.026)	0.153*** (0.000)	0.039 (0.134)	0.058** (0.024)	0.054** (0.034)	1.000								
Serious injury (wave 2)	0.014 (0.576)	-0.014 (0.589)	0.001 (0.957)	0.026 (0.305)	0.032 (0.216)	0.003 (0.894)	0.052** (0.043)	0.064** (0.013)	0.059** (0.022)	0.034 (0.188)	0.067*** (0.009)	1.000							
Serious injury (wave 3)	0.015 (0.565)	-0.028 (0.280)	0.000 (0.996)	0.013 (0.606)	0.027 (0.290)	0.030 (0.242)	0.036 (0.161)	0.036 (0.162)	0.045* (0.080)	0.051** (0.046)	-0.003 (0.914)	-0.003 (0.904)	1.000						
Female	-0.063** (0.014)	-0.013 (0.625)	-0.031 (0.236)	-0.062** (0.017)	-0.067*** (0.009)	-0.072*** (0.005)	0.079*** (0.000)	0.082*** (0.001)	0.098*** (0.000)	0.122*** (0.000)	0.050* (0.205)	0.013 (0.205)	0.050* (0.205)	1.000					
Domestic violence reported (wave 1)	-0.017 (0.516)	0.000 (0.988)	-0.026 (0.316)	-0.005 (0.846)	-0.016 (0.523)	-0.018 (0.482)	0.143*** (0.000)	0.060** (0.019)	0.060** (0.019)	0.111*** (0.000)	-0.005 (0.839)	-0.024 (0.349)	-0.005 (0.839)	-0.004 (0.908)	1.000				
Domestic violence reported (wave 2)	-0.044* (0.088)	-0.079*** (0.002)	-0.037 (0.155)	-0.028 (0.271)	-0.031 (0.230)	-0.028 (0.309)	0.044* (0.258)	0.002 (0.945)	0.049* (0.056)	0.073*** (0.004)	0.007 (0.779)	-0.005 (0.849)	0.007 (0.849)	-0.005 (0.849)	0.076*** (0.003)	1.000			
Domestic violence reported (wave 3)	-0.059** (0.021)	-0.060** (0.019)	-0.039 (0.134)	-0.028 (0.275)	-0.046* (0.071)	-0.075*** (0.000)	0.079*** (0.000)	0.071** (0.002)	0.071** (0.002)	0.085*** (0.000)	0.050* (0.205)	0.013 (0.205)	0.050* (0.205)	0.050* (0.205)	-0.094*** (0.000)	-0.102*** (0.000)	1.000		
Child cognitive development (wave 3)	-0.035 (0.169)	0.009 (0.715)	-0.019 (0.453)	-0.042 (0.101)	-0.046* (0.073)	-0.033 (0.198)	-0.039 (0.129)	-0.053*** (0.004)	-0.073*** (0.004)	-0.099*** (0.000)	0.019 (0.470)	0.003 (0.908)	0.003 (0.908)	0.003 (0.908)	0.003 (0.908)	0.003 (0.908)	0.003 (0.908)	0.003 (0.908)	0.003 (0.908)
Child cognitive development (wave 2)	-0.018 (0.496)	0.034 (0.191)	-0.005 (0.833)	-0.008 (0.751)	-0.025 (0.326)	-0.045* (0.080)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)	0.002 (0.945)
Mother's capital	0.019 (0.471)	0.050* (0.052)	0.030 (0.249)	-0.005 (0.833)	0.013 (0.603)	0.006 (0.826)	-0.104** (0.000)	-0.016 (0.547)	-0.016 (0.547)	-0.057** (0.001)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)	-0.011 (0.670)
Reasons with child when misbehaves (wave 2)	-0.074*** (0.004)	0.003 (0.944)	-0.056** (0.103)	-0.099*** (0.011)	-0.066** (0.060)	-0.066** (0.016)	-0.012 (0.419)	-0.017 (0.504)	-0.041 (0.108)	-0.041 (0.108)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)	0.008 (0.725)
Reasons with child when misbehaves (wave 3)	-0.054** (0.029)	-0.015 (0.560)	-0.041 (0.109)	-0.065** (0.012)	-0.054** (0.035)	-0.048* (0.062)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)	0.006 (0.829)
Corporal punishment if child misbehaves (wave 2)	0.086*** (0.001)	0.033 (0.205)	0.064*** (0.012)	0.084*** (0.001)	0.080*** (0.002)	0.084*** (0.001)	0.052** (0.044)	0.031 (0.044)	0.031 (0.044)	0.031 (0.044)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)	0.023 (0.363)
Corporal punishment if child misbehaves (wave 2)	0.051** (0.049)	0.002 (0.944)	0.042 (0.103)	0.041 (0.113)	0.048* (0.060)	0.062** (0.016)	0.006 (0.826)	0.067** (0.010)	0.021 (0.419)	0.034 (0.193)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)	0.035 (0.174)
Excessive drinking (wave 1)	-0.027 (0.293)	-0.029 (0.263)	-0.019 (0.455)	-0.026 (0.306)	-0.021 (0.409)	-0.020 (0.430)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)	0.004 (0.871)
Excessive drinking (wave 2)	-0.023 (0.375)	-0.031 (0.226)	-0.018 (0.630)	-0.010 (0.698)	-0.010 (0.490)	-0.027 (0.290)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)	0.026 (0.321)
Excessive drinking (wave 3)	-0.026 (0.319)	-0.046* (0.073)	0.002 (0.946)	-0.009 (0.729)	-0.018 (0.494)	-0.041 (0.110)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)	0.013 (0.621)
No. of smokers in household (wave 2)	0.010 (0.884)	0.002 (0.948)	0.007 (0.777)	0.007 (0.787)	0.013 (0.615)	0.012 (0.652)	0.007 (0.776)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)	0.004 (0.870)
No. of smokers in household (wave 3)	0.006 (0.803)	0.003 (0.897)	0.007 (0.772)	0.006 (0.801)	0.007 (0.772)	0.002 (0.932)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)	0.043* (0.096)
Searched for help (wave 3)	-0.006 (0.808)	-0.009 (0.732)	-0.013 (0.612)	-0.011 (0.983)	0.004 (0.886)	-0.011 (0.674)	0.091*** (0.000)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)	0.045* (0.084)
Wealth index (wave 3)	-0.077*** (0.003)	-0.002 (0.937)	-0.039 (0.133)	-0.051** (0.049)	-0.086*** (0.001)	-0.113*** (0.000)	-0.046* (0.071)	-0.128*** (0.000)	-0.128*** (0.000)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)	-0.071*** (0.006)

Notes: **Mother's psychological malaise:** No reports on domestic violence for the 4th survey were collected. **Mother's depression/lack of life satisfaction** are the predicted common factor based on WHO SQ20 depression questionnaire for the first, second and fourth surveys. For the third survey mother's life satisfaction is the predicted common factor based on 8 item questionnaire of life satisfaction. The questions were rescaled to measure lack of satisfaction. The WHO SQ20 was collected in the 3rd survey, but they are not available to the public. The Cronbach α scale reliability coefficient of these 4 measures is 0.4702. The Cronbach α 's for the 1st, 2nd, 3rd and 4th set of questions are 0.8605, 0.8467, 0.7523, and 0.8695. **Child injuries:** Burns, lacerations, broken bones, etc. **Cognitive development:** Factor estimated from measures of cognitive development. No measures are available for the first survey. **Domestic violence:** Mother's report of incidence of domestic violence. No report is available for the 4th survey. **Lottery decision:** Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.

Table 5: Fixed-Effect regression of domestic violence on several outcomes

VARIABLES	Mother's psych. malaise		Child		Cognitive	
	All data	First 3 surveys	had serious injury		Development	
Domestic violence reported		0.076*** [0.023] (0.001)	0.002 [0.020] (0.929)	-0.002 [0.021] (0.917)	-0.164*** [0.056] (0.004)	-0.153*** [0.057] (0.008)
Mother's psych. malaise				0.029** [0.015] (0.046)		-0.105*** [0.037] (0.004)
HH per-capita consumption	-0.000 [0.000] (0.962)	0.000 [0.000] (0.963)	0.000 [0.000] (0.952)	0.000 [0.000] (0.993)	-0.000 [0.000] (0.876)	-0.000 [0.000] (0.838)
Wealth index	-0.167*** [0.032] (0.000)	-0.242*** [0.046] (0.000)	-0.136*** [0.041] (0.001)	-0.135*** [0.042] (0.001)	0.057 [0.129] (0.658)	0.034 [0.131] (0.798)
Constant	0.098*** [0.017] (0.000)	0.128*** [0.023] (0.000)	0.168*** [0.020] (0.000)	0.167*** [0.020] (0.000)	0.009 [0.069] (0.895)	0.023 [0.070] (0.745)
Observations	7,489	5,669	5,721	5,669	3,533	3,495
R-squared	0.005	0.010	0.003	0.004	0.005	0.010
Number of individuals	1,919	1,919	1,919	1,919	1,907	1,906

s.e. in brackets, p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Notes: **Mother's psych. malaise:** No reports on domestic violence for the 4th survey were collected. Mother's depression/lack of life satisfaction are the predicted common factor based on WHO SQ20 depression questionnaire for the first, second and fourth surveys. For the third survey mother's life satisfaction is the predicted common factor based on 8 item questionnaire of life satisfaction. The questions were rescaled to measure lack of satisfaction. The WHO SQ20 was collected in the 3rd survey, but they are not available to the public. The Cronbach α scale reliability coefficient of these 4 measures is 0.4702. The Cronbach α 's for the 1st, 2nd, 3rd and 4th set of questions are 0.8605, 0.8467, 0.7523, and 0.8695. **Child injuries:** Burns, lacerations, broken bones, etc. **Cognitive development:** Factor estimated from measures of cognitive development. No measures are available for the first survey. **Domestic violence:** Mother's report of incidence of domestic violence. No report is available for the 4th survey.

Table 6: OLS REGRESSIONS (CORRECTING FOR MEASUREMENT ERROR)

Cog. Develop.	Lottery choice (y)	Lottery choice ¹					Self-esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	BMI at 12 years	4th wave - 12 year old		Cog. Develop.
		y ≥ 2	y ≥ 3	y ≥ 4	y ≥ 5	y ≥ 6									Daily hours playing	Daily hours studying	
Par. Investment q. 05 q. 95	-0.093	0.030	-0.056	-0.087	-0.105	-0.121	0.068	0.027	0.490	0.050	0.207	-0.117	0.260	0.218	-0.089	0.342	0.368
	-0.242	-0.111	-0.204	-0.233	-0.262	-0.286	-0.034	-0.044	0.288	-0.083	-0.002	-0.237	0.099	0.048	-0.262	0.137	0.220
	0.584	0.045	0.101	0.054	0.028	0.007	0.153	0.101	0.668	0.203	0.384	0.034	0.428	0.347	0.064	0.515	0.496
Domestic violence q. 05 q. 95	-0.146	-0.127	-0.102	-0.092	-0.123	-0.160	-0.038	-0.010	-0.037	0.057	0.002	0.037	-0.178	-0.021	0.049	-0.017	-0.060
	-0.151	-0.274	-0.235	-0.207	-0.246	-0.289	-0.104	-0.074	-0.124	-0.029	-0.081	-0.069	-0.338	-0.127	-0.050	-0.123	-0.152
	0.023	-0.031	0.003	0.011	-0.013	-0.053	0.013	0.037	0.030	0.165	0.116	0.135	-0.052	0.071	0.175	0.072	0.007
Cog. Develop. at 5 q. 05 q. 95	0.411	0.074	0.017	0.020	0.011	-0.005	0.053	0.057	0.044	-0.068	-0.054	-0.019	-0.024	0.032	-0.136	0.007	0.400
	0.316	-0.075	-0.074	-0.076	-0.084	-0.100	-0.003	-0.006	-0.046	-0.160	-0.143	-0.139	-0.116	-0.063	-0.241	-0.089	0.313
	0.518	0.117	0.119	0.110	0.107	0.090	0.109	0.127	0.136	0.028	0.047	0.086	0.075	0.133	-0.043	0.107	0.495
Mother's human cap. q. 05 q. 95	0.193	0.052	0.102	0.075	0.128	0.102	0.102	0.017	-0.017	0.090	0.015	0.224	0.093	0.037	0.268	-0.085	0.279
	0.135	-0.016	0.092	0.004	0.056	0.029	0.051	-0.019	-0.071	0.018	-0.055	0.145	0.030	-0.017	0.193	-0.148	0.227
	0.260	0.189	0.130	0.176	0.151	0.198	0.171	0.053	0.045	0.168	0.083	0.293	0.155	0.091	0.333	-0.016	0.343
Wealth index q. 05 q. 95	0.135	-0.030	-0.007	-0.003	-0.042	-0.053	0.057	0.030	0.089	-0.123	-0.005	0.051	0.095	0.185	0.088	0.070	0.087
	0.070	-0.083	-0.062	-0.057	-0.098	-0.107	0.020	-0.002	0.035	-0.180	-0.073	-0.011	0.034	0.135	0.031	0.011	0.036
	0.210	0.025	0.050	0.047	0.014	0.006	0.094	0.067	0.160	-0.070	0.069	0.110	0.162	0.249	0.148	0.142	0.148
Household size q. 05 q. 95	-0.022	-0.012	0.015	-0.012	-0.020	-0.011	-0.030	-0.016	0.005	0.017	-0.033	0.073	-0.045	0.004	0.030	-0.023	0.001
	-0.050	-0.055	-0.024	-0.054	-0.061	-0.053	-0.053	-0.037	-0.033	-0.023	-0.073	0.034	-0.085	-0.033	-0.007	-0.058	-0.028
	0.007	0.028	0.018	0.055	0.028	0.020	-0.006	0.004	0.048	0.055	0.007	0.109	-0.005	0.042	0.071	0.015	0.029
Two-parents hh. q. 05 q. 95	-0.027	-0.004	-0.020	0.006	0.005	-0.008	-0.005	0.006	-0.044	0.013	-0.037	0.025	-0.014	-0.042	-0.017	-0.012	0.010
	-0.054	-0.043	-0.057	-0.033	-0.045	-0.034	-0.029	-0.020	-0.089	-0.023	-0.069	-0.018	-0.052	-0.085	-0.062	-0.053	-0.016
	0.005	0.035	0.019	0.045	0.032	0.044	0.033	0.019	-0.001	0.051	0.001	0.064	0.026	0.001	0.025	0.030	0.037

Notes: Parameter estimates and 90% confidence interval (q.05,q.95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

¹Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable y ≥ i means that the choice was i or higher for i ∈ {2, 3, 4, 5, 6}.

Table 7: REDUCED FORM REGRESSIONS CORRECTED FOR MEASUREMENT ERROR

Par.	End. variables		Cog. Develop.	Lottery choice (y)	y ≥ 2	y ≥ 3	y ≥ 4	y ≥ 5	y ≥ 6	Self-esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	BMI at 8 years	4th. wave - 12 year old			
	Inv.	Dom.																Daily hours playing	Daily hours studying	Cog. Develop.	
HH. Income	0.101	0.008	0.023	0.012	0.035	-0.016	0.000	0.006	0.028	-0.002	0.000	0.093	-0.015	-0.010	-0.029	-0.003	0.084	0.017	-0.004	0.044	
	0.047	-0.018	-0.003	-0.031	0.017	-0.061	-0.042	-0.036	-0.014	-0.028	-0.022	0.021	-0.055	-0.049	-0.064	-0.047	0.031	0.031	-0.015	-0.046	0.014
	0.190	0.039	0.052	0.053	0.060	0.026	0.041	0.044	0.067	0.020	0.018	0.167	0.033	0.021	0.009	0.041	0.142	0.057	0.049	0.074	
Gender wage gap	0.007	-0.053	0.063	0.070	0.035	0.047	0.049	0.064	0.083	0.013	-0.010	-0.155	0.163	-0.069	0.226	-0.014	-0.130	0.165	-0.076	0.043	
	q. 05	-0.029	-0.096	0.033	0.024	-0.014	0.005	0.017	0.036	-0.014	-0.035	-0.207	0.116	-0.115	0.179	-0.067	-0.183	0.120	-0.126	0.011	
	q. 95	0.043	-0.003	0.092	0.120	0.083	0.098	0.099	0.114	0.130	0.042	-0.101	0.208	-0.023	0.270	0.038	-0.079	0.213	-0.027	0.074	
Cog. Develop. at 5	0.167	-0.042	0.487	0.020	0.087	0.020	0.018	0.003	-0.012	0.069	0.062	0.109	-0.034	-0.027	-0.002	0.025	0.058	-0.127	0.053	0.469	
	q. 05	-0.092	-0.134	0.388	-0.070	-0.006	-0.070	-0.072	-0.085	-0.102	0.014	-0.001	0.023	-0.122	-0.120	-0.062	-0.038	-0.042	-0.042	0.381	
	q. 95	0.240	0.047	0.579	0.122	0.186	0.121	0.116	0.094	0.083	0.126	0.190	0.055	0.069	0.107	0.112	0.146	-0.044	0.145	0.563	
Mother's cap.	0.056	0.054	0.212	0.088	0.042	0.085	0.058	0.102	0.069	0.105	0.022	0.050	0.055	0.049	0.171	0.100	0.081	0.232	-0.051	0.285	
	q. 05	-0.001	-0.022	0.157	0.020	-0.024	-0.009	0.027	0.000	0.057	-0.014	-0.003	-0.014	-0.018	0.091	0.040	0.028	0.164	-0.112	0.235	
	q. 95	0.124	0.116	0.275	0.163	0.116	0.160	0.135	0.174	0.139	0.061	0.105	0.132	0.116	0.244	0.161	0.132	0.295	0.015	0.342	
Wealth index	0.216	-0.060	0.240	-0.042	-0.004	-0.008	-0.016	-0.054	-0.072	0.072	0.034	0.171	-0.103	0.040	0.028	0.169	0.205	0.052	0.153	0.163	
	q. 05	0.148	-0.100	0.199	-0.086	-0.043	-0.050	-0.060	-0.117	0.043	0.002	0.125	-0.151	-0.004	-0.019	0.126	0.156	0.006	0.109	0.123	
	q. 95	0.278	-0.013	0.280	0.000	0.036	0.033	0.027	-0.011	-0.029	0.100	0.214	-0.058	0.085	0.074	0.212	0.254	0.098	0.197	0.198	
Household size	0.009	0.021	-0.021	-0.016	-0.026	0.011	-0.015	-0.021	-0.015	-0.029	-0.015	0.009	0.017	-0.029	0.067	-0.047	0.006	0.025	-0.018	0.000	
	q. 05	-0.010	-0.017	-0.049	-0.058	-0.068	-0.028	-0.056	-0.063	-0.054	-0.053	-0.028	-0.022	-0.069	0.029	-0.087	-0.031	-0.011	-0.054	-0.030	
	q. 95	0.030	0.054	0.007	0.025	0.014	0.050	0.025	0.019	0.022	0.005	0.050	0.056	0.010	0.103	-0.008	0.042	0.063	0.020	0.028	
Two-parents hh.	0.031	0.010	-0.012	-0.010	-0.022	0.004	-0.009	-0.002	-0.016	-0.003	0.008	-0.023	0.009	-0.022	0.016	-0.008	-0.030	-0.024	-0.001	0.020	
	q. 05	0.007	-0.026	-0.041	-0.049	-0.058	-0.036	-0.050	-0.040	-0.026	-0.018	-0.065	-0.028	-0.055	-0.028	-0.046	-0.073	-0.066	-0.041	-0.007	
	q. 95	0.053	0.046	0.019	0.026	0.014	0.040	0.029	0.035	0.022	0.037	0.016	0.048	0.014	0.055	0.029	0.010	0.016	0.038	0.045	

Notes: Parameter estimates and 90% confidence interval (q.05,q.95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

¹ Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.

Table 8: IV REGRESSIONS CORRECTED FOR MEASUREMENT ERROR AND CORRECTED SIGNIFICANCE TESTS

	Cog. Develop.	Lottery choice (y)	Lottery $y \geq 2$						Self-esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	BMI at 12 years		4th wave - 12 year old		Cog. Develop.
			$y \geq 2$	$y \geq 3$	$y \geq 4$	$y \geq 5$	$y \geq 6$	at 12 years								at 12 years	Daily hours playing	Daily hours studying		
Par. Investment	0.290	0.234	0.404	-0.085	0.078	0.177	0.426	-0.018	-0.026	0.660	0.109	-0.232	0.057	-0.049	0.482	0.464	-0.190	0.460		
q. 05	-0.474	-0.504	0.028	-0.868	-0.630	-0.539	-0.370	-0.362	-1.007	-1.630	-1.340	-2.198	-1.279	-1.444	-1.121	-1.279	-1.444	-0.136		
q. 95	1.526	1.410	1.207	0.669	0.927	1.259	1.956	0.318	0.291	2.630	2.024	0.501	2.674	0.517	2.196	3.006	0.663	1.597		
Domestic violence	-1.264	-1.246	-0.585	-0.850	-0.854	-1.181	-1.484	-0.239	0.189	2.938	-3.050	1.244	-4.212	0.230	2.667	-3.158	1.499	-0.856		
q. 05	-6.059	-4.952	-2.970	-3.630	-3.719	-4.695	-5.767	-1.628	-0.564	6.937	-11.830	-0.191	-16.735	-1.170	0.242	-15.609	-0.564	-4.180		
q. 95	-0.127	0.191	0.847	0.482	0.427	0.345	0.496	0.774	1.268	10.595	-0.821	4.880	-1.210	2.855	12.666	-1.801	7.458	1.969		
Chernozhukov & Hansen significance test																				
H_0 : Par. Inv. = 0 & Dom. Viol. = 0																				
Smallest est. effect of D.V. -0.300																				
Wald test, $\chi(2)$ 11.746																				
p-value 0.003																				
% of bootstrap replications not rejecting H_0 0.067																				
Cog. Develop. at 5	0.369	-0.070	-0.002	-0.006	-0.034	-0.072	-0.141	0.061	0.069	0.113	-0.184	0.067	-0.194	0.042	0.084	-0.306	0.131	0.372		
q. 05	-0.055	-0.392	-0.233	-0.254	-0.284	-0.361	-0.522	-0.048	-0.021	-0.397	-0.842	-0.186	-1.068	-0.105	-0.458	-1.041	-0.188	0.156		
q. 95	0.619	0.148	0.156	0.182	0.146	0.130	0.111	0.159	0.179	0.789	0.338	0.411	0.482	0.228	0.674	0.369	0.504	0.557		
Mother's human cap.	0.233	0.142	0.051	0.134	0.098	0.157	0.126	0.112	0.011	-0.152	0.217	-0.011	0.391	0.093	-0.141	0.436	-0.151	0.327		
q. 05	0.075	-0.012	-0.061	0.014	-0.026	0.009	-0.057	0.046	-0.053	-0.585	-0.114	-0.210	-0.061	-0.036	-0.758	0.064	-0.527	0.182		
q. 95	0.422	0.363	0.193	0.331	0.285	0.363	0.393	0.192	0.067	0.151	0.660	0.162	1.032	0.193	0.152	1.159	0.042	0.562		
Wealth index	0.095	-0.172	-0.125	-0.042	-0.086	-0.170	-0.261	0.067	0.054	0.218	-0.311	0.172	-0.230	0.193	0.261	-0.218	0.280	0.023		
q. 05	-0.410	-0.585	-0.365	-0.338	-0.412	-0.548	-0.732	-0.063	-0.032	-0.320	-1.091	-0.038	-1.304	0.031	-0.269	-1.243	0.019	-0.358		
q. 95	0.336	0.042	0.011	0.176	0.103	0.037	-0.035	0.175	0.172	0.842	0.150	0.589	0.344	0.447	0.978	0.323	0.780	0.197		
Household size	-0.005	0.007	-0.017	0.031	0.002	-0.001	0.010	-0.023	-0.019	-0.059	0.079	-0.052	0.157	-0.050	-0.036	0.070	-0.039	0.013		
q. 05	-0.106	-0.084	-0.086	-0.040	-0.071	-0.085	-0.091	-0.061	-0.056	-0.280	-0.110	-0.165	-0.094	-0.110	-0.253	-0.170	-0.174	-0.062		
q. 95	0.099	0.127	0.059	0.114	0.095	0.109	0.151	0.017	0.016	0.142	0.307	0.046	0.475	0.010	0.147	0.319	0.096	0.100		
Two-parents hh.	-0.004	-0.007	-0.028	0.012	-0.006	0.003	-0.016	0.000	0.004	-0.073	0.036	-0.034	0.054	-0.008	-0.076	0.018	-0.022	0.018		
q. 05	-0.085	-0.107	-0.093	-0.061	-0.077	-0.084	-0.130	-0.037	-0.036	-0.285	-0.154	-0.142	-0.209	-0.070	-0.309	-0.173	-0.171	-0.058		
q. 95	0.135	0.096	0.049	0.100	0.082	0.103	0.106	0.040	0.038	0.108	0.275	0.065	0.372	0.050	0.093	0.305	0.086	0.109		

Notes: Parameter estimates and 90% confidence interval (q. 05,q. 95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

1 Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.

Table 9: DOMESTIC VIOLENCE IV REGRESSIONS CORRECTED FOR MEASUREMENT ERROR AND CORRECTED SIGNIFICANCE TESTS

	Cog. Develop.	Lottery choice (y)	Lottery						Self-esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	BMI at 8 years	4th wave - 12 year old	
			y ≥ 2	y ≥ 3	y ≥ 4	y ≥ 5	y ≥ 6	Daily hours playing									Daily hours studying	Cog. Develop.
Domestic violence	-1.310	-1.283	-0.648	-0.837	-0.866	-1.209	-1.551	-0.235	0.193	2.843	-3.065	1.277	-4.221	0.238	2.577	-3.239	1.532	-0.928
q. 05	-5.472	-5.377	-2.994	-4.088	-4.117	-4.863	-6.585	-1.558	-0.520	0.968	-13.106	0.081	-18.687	-1.290	0.377	-14.508	-0.345	-13.701
q. 95	0.750	-0.082	0.728	0.341	0.240	0.001	-0.273	0.773	1.264	12.019	-1.069	5.487	-1.626	2.470	12.310	1.889	8.108	13.146
Chernozhukov & Hansen test for weak instruments																		
H ₀ :Dom. Viol. = 0	-0.450	-0.400	0.000	0.000	0.000	-0.350	-0.600	0.000	0.000	1.450	-1.600	0.300	-2.350	0.000	1.200	-1.500	0.500	-0.300
Smallest estimate (95% CI)	9.888	6.294	1.537	2.779	2.849	5.748	8.981	0.811	1.121	30.111	34.836	5.575	72.523	0.096	20.867	36.653	7.498	6.671
Wald test X(1)	0.002	0.012	0.215	0.096	0.091	0.017	0.003	0.368	0.290	0.000	0.000	0.018	0.000	0.757	0.000	0.000	0.006	0.010
% of bootstrap replications not rejecting H ₀	0.053	0.188	0.635	0.457	0.481	0.225	0.090	0.752	0.763	0.001	0.000	0.244	0.000	0.839	0.007	0.000	0.148	0.175
Cog. Develop. at 5	0.410	-0.035	0.059	-0.019	-0.022	-0.045	-0.075	0.058	0.065	0.215	-0.166	0.029	-0.185	0.034	0.160	-0.233	0.101	0.444
q. 05	0.091	-0.307	-0.106	-0.228	-0.251	-0.302	-0.392	-0.036	-0.013	-0.194	-0.796	-0.170	-1.014	-0.093	-0.269	-0.894	-0.159	-1.532
q. 95	0.643	0.146	0.193	0.129	0.118	0.129	0.144	0.133	0.163	0.754	0.293	0.306	0.421	0.173	0.698	0.309	0.445	2.401
Mother's human cap.	0.253	0.156	0.076	0.129	0.102	0.167	0.152	0.111	0.010	-0.112	0.223	-0.025	0.394	0.090	-0.112	0.463	-0.162	0.354
q. 05	0.103	0.016	-0.036	0.022	-0.012	0.029	-0.012	0.047	-0.051	-0.486	-0.108	-0.242	-0.049	-0.029	-0.653	0.103	-0.565	-0.219
q. 95	0.440	0.386	0.213	0.308	0.290	0.385	0.426	0.190	0.063	0.186	0.671	0.117	1.040	0.177	0.178	1.180	0.019	0.796
Wealth index	0.167	-0.117	-0.030	-0.062	-0.068	-0.129	-0.160	0.063	0.048	0.374	-0.286	0.117	-0.216	0.181	0.374	-0.108	0.236	0.132
q. 05	-0.176	-0.413	-0.186	-0.278	-0.291	-0.400	-0.499	-0.026	-0.006	0.187	-0.879	0.009	-1.014	0.096	0.164	-0.788	0.096	-2.960
q. 95	0.285	-0.009	0.062	0.032	0.024	-0.027	-0.035	0.126	0.137	0.930	-0.066	0.411	0.067	0.333	0.902	0.181	0.606	3.292
Household size	-0.003	0.011	-0.011	0.030	0.003	0.002	0.017	-0.024	-0.020	-0.049	0.081	-0.056	0.158	-0.050	-0.029	0.077	-0.041	0.020
q. 05	-0.099	-0.077	-0.078	-0.040	-0.067	-0.078	-0.078	-0.062	-0.056	-0.273	-0.122	-0.163	-0.120	-0.108	-0.245	-0.146	-0.184	-0.231
q. 95	0.103	0.124	0.059	0.116	0.097	0.110	0.160	0.018	0.015	0.137	0.307	0.036	0.467	0.008	0.138	0.339	0.070	0.218
Two-parents hh.	0.005	0.000	-0.016	0.009	-0.003	0.008	-0.003	-0.001	0.004	-0.053	0.040	-0.041	0.056	-0.009	-0.061	0.032	-0.027	0.032
q. 05	-0.071	-0.079	-0.074	-0.053	-0.066	-0.065	-0.101	-0.036	-0.036	-0.249	-0.130	-0.162	-0.188	-0.067	-0.296	-0.149	-0.191	-0.337
q. 95	0.130	0.114	0.063	0.097	0.093	0.113	0.123	0.039	0.039	0.112	0.279	0.039	0.372	0.042	0.091	0.341	0.061	0.317

Notes: Parameter estimates and 90% confidence interval (q. 05;q. 95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

1 Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable y ≥ i means that the choice was i or higher for i ∈ {2, 3, 4, 5, 6}.

Table 10: PARENTAL INVESTMENT IV REGRESSIONS CORRECTED FOR MEASUREMENT ERROR AND CORRECTED SIGNIFICANCE TESTS

	Cog. Develop.	Lottery choice (y)	y ≥ 2	y ≥ 3	y ≥ 4	y ≥ 5	y ≥ 6	Self-esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	4th wave - 12 year old				
														Daily hours studying	BMI at 8 years	Daily hours playing	Daily hours studying	Cog. Develop.
Par. Investment	0.233	0.139	0.354	-0.151	0.013	0.090	0.313	-0.032	-0.012	0.880	-0.115	-0.137	-0.254	-0.030	0.731	0.184	-0.059	0.397
q. 05	-0.042	-0.282	0.140	-0.700	-0.465	-0.319	-0.087	-0.291	-0.232	0.158	-0.672	-0.638	-0.830	-0.602	0.275	-0.156	-0.596	0.089
q. 95	0.749	0.699	0.807	0.294	0.505	0.608	0.951	0.205	0.207	2.287	0.318	0.174	0.105	0.419	1.698	0.648	0.419	1.037
Chernozhukov & Hansen test for weak instruments																		
H ₀ : Par. Invest. = 0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.450	0.000	0.000	0.000	0.000	0.350	0.000	0.000	0.150
Smallest estimate (95% CI)	1.975	0.334	2.296	0.402	0.003	0.130	1.726	0.699	0.022	14.379	0.273	0.354	1.341	0.020	10.728	0.678	0.065	7.029
Wald test X(1)	0.160	0.563	0.130	0.526	0.956	0.718	0.189	0.403	0.882	0.000	0.601	0.552	0.247	0.888	0.001	0.410	0.799	0.008
% of bootstrap replications not rejecting H ₀	0.612	0.822	0.580	0.831	0.895	0.884	0.611	0.895	0.902	0.141	0.870	0.881	0.723	0.868	0.106	0.786	0.837	0.205
Cog. Develop. at 5	0.445	-0.010	0.025	0.037	0.008	-0.015	-0.069	0.070	0.063	-0.017	-0.038	0.003	0.005	0.031	-0.049	-0.187	0.073	0.396
q. 05	0.329	-0.133	-0.083	-0.079	-0.115	-0.139	-0.205	0.001	-0.002	-0.217	-0.145	-0.106	-0.126	-0.077	-0.205	-0.309	-0.042	0.280
q. 95	0.548	0.106	0.125	0.161	0.125	0.093	0.043	0.139	0.143	0.124	0.094	0.124	0.129	0.150	0.068	-0.082	0.185	0.497
Mother's human cap.	0.205	0.099	0.029	0.106	0.070	0.116	0.075	0.108	0.019	-0.042	0.102	0.035	0.238	0.098	0.012	0.260	-0.068	0.273
q. 05	0.146	0.024	-0.042	0.032	-0.006	0.038	-0.008	0.057	-0.018	-0.139	0.027	-0.032	0.153	0.034	-0.068	0.185	-0.139	0.216
q. 95	0.269	0.172	0.108	0.182	0.142	0.190	0.151	0.160	0.059	0.040	0.183	0.105	0.317	0.167	0.079	0.326	-0.002	0.337
Wealth index	0.188	-0.079	-0.081	0.021	-0.022	-0.083	-0.151	0.082	0.039	-0.005	-0.086	0.079	0.077	0.176	0.060	0.010	0.171	0.081
q. 05	0.066	-0.213	-0.187	-0.091	-0.148	-0.211	-0.302	0.018	-0.016	-0.306	-0.197	-0.005	-0.023	0.068	-0.140	-0.110	0.047	-0.054
q. 95	0.262	0.027	-0.011	0.157	0.090	0.020	-0.050	0.147	0.107	0.171	0.048	0.199	0.203	0.310	0.190	0.105	0.293	0.161
Household size	-0.021	-0.015	-0.029	0.015	-0.013	-0.021	-0.016	-0.028	-0.014	-0.001	0.020	-0.026	0.074	-0.047	-0.003	0.025	-0.018	-0.001
q. 05	-0.050	-0.059	-0.075	-0.024	-0.058	-0.063	-0.061	-0.053	-0.036	-0.046	-0.061	-0.067	0.036	-0.088	-0.047	-0.012	-0.056	-0.031
q. 95	0.007	0.027	0.013	0.057	0.030	0.020	0.021	-0.005	0.006	0.041	0.062	0.015	0.111	-0.007	0.036	0.064	0.023	0.026
Two-parents hh.	-0.021	-0.009	-0.031	0.012	-0.006	0.000	-0.019	-0.003	0.007	-0.057	0.019	-0.026	0.030	-0.008	-0.056	-0.024	-0.003	0.007
q. 05	-0.051	-0.051	-0.070	-0.029	-0.049	-0.041	-0.062	-0.028	-0.019	-0.122	-0.019	-0.060	-0.014	-0.046	-0.111	-0.074	-0.045	-0.024
q. 95	0.011	0.031	0.007	0.053	0.035	0.040	0.022	0.023	0.037	-0.006	0.062	0.013	0.071	0.033	-0.011	0.017	0.041	0.035

Notes: Parameter estimates and 90% confidence interval (q. 05,q.95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

1 Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.

Appendix

Table 11: OLS REGRESSIONS (CORRECTING FOR MEASUREMENT ERROR)

	Cog. Devlp.	Lottery choice (y)	Lottery choice					Self-esteem	Locus of control	BMI at 8 years	Days of phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	4th wave - 12 year old		Cog. Devlp.
			y ≥ 2	y ≥ 3	y ≥ 4	y ≥ 5	y ≥ 6								BMI at 12 years	Daily hours playing	
Par. Investment (r2)	0.004	-0.002	-0.004	0.002	-0.003	-0.003	0.000	0.001	0.003	-0.002	-0.004	-0.004	0.004	0.003	0.002	0.004	0.004
q. 05	-0.003	-0.023	-0.023	-0.013	-0.023	-0.027	-0.019	-0.003	-0.003	-0.020	-0.046	-0.004	-0.004	-0.012	-0.005	-0.004	-0.001
q. 95	0.043	0.005	0.012	0.011	0.008	0.006	0.005	0.013	0.049	0.002	0.001	0.033	0.017	0.031	0.038	0.046	
Domestic violence	-0.070	-0.143	-0.128	-0.100	-0.090	-0.120	-0.156	-0.041	-0.054	0.055	-0.004	0.041	-0.187	0.052	-0.028	-0.072	
q. 05	-0.158	-0.270	-0.317	-0.233	-0.205	-0.242	-0.281	-0.107	-0.138	-0.030	-0.085	-0.062	-0.346	-0.045	-0.132	-0.164	
q. 95	0.010	-0.028	-0.016	0.004	0.013	-0.010	-0.048	0.011	0.016	0.163	0.105	0.138	-0.057	0.065	0.059	-0.004	
Cog. Devlp. at 5	0.475	0.007	0.079	0.008	0.006	-0.005	-0.024	0.063	0.121	-0.059	-0.020	-0.039	0.019	0.068	0.062	0.459	
q. 05	0.378	-0.085	-0.014	-0.084	-0.086	-0.093	-0.115	0.007	0.033	-0.147	-0.113	-0.156	-0.069	-0.027	-0.034	0.371	
q. 95	0.569	0.100	0.173	0.108	0.100	0.086	0.070	0.119	0.203	0.034	0.076	0.071	0.105	0.160	0.152	0.551	
Mother's human cap.	0.220	0.109	0.054	0.099	0.070	0.122	0.095	0.106	0.010	0.093	0.027	0.217	0.107	0.048	0.264	0.297	
q. 05	0.165	0.042	-0.013	0.031	0.000	0.050	0.023	0.057	-0.017	0.023	-0.040	0.140	0.048	-0.006	0.191	0.247	
q. 95	0.285	0.182	0.131	0.171	0.145	0.193	0.164	0.152	0.062	0.169	0.095	0.287	0.166	0.099	0.329	0.357	
Wealth index	0.245	-0.053	-0.001	-0.021	-0.024	-0.068	-0.082	0.073	0.036	-0.111	0.045	0.023	0.158	0.238	0.153	0.176	
q. 05	0.203	-0.098	-0.040	-0.063	-0.069	-0.113	-0.124	0.045	0.002	-0.158	0.004	-0.024	0.115	0.192	0.108	0.137	
q. 95	0.286	-0.010	0.041	0.022	0.020	-0.024	-0.036	0.101	0.068	-0.068	0.088	0.070	0.203	0.284	0.197	0.215	
Household size	-0.019	-0.013	-0.022	0.014	-0.014	-0.021	-0.013	-0.029	-0.015	0.017	-0.030	0.072	-0.042	0.007	0.029	0.006	
q. 05	-0.048	-0.057	-0.065	-0.024	-0.055	-0.062	-0.055	-0.052	-0.037	-0.022	-0.070	0.032	-0.081	-0.031	-0.008	-0.023	
q. 95	0.010	0.026	0.018	0.053	0.026	0.018	0.024	-0.005	0.004	0.058	0.009	0.107	-0.001	0.044	0.069	0.034	
Two-parents hh.	-0.014	-0.007	-0.019	0.005	-0.008	0.001	-0.011	-0.003	0.006	0.014	-0.030	0.021	-0.006	-0.036	-0.019	0.020	
q. 05	-0.042	-0.045	-0.055	-0.034	-0.048	-0.037	-0.049	-0.026	-0.020	-0.022	-0.065	-0.022	-0.044	-0.079	-0.063	-0.006	
q. 95	0.016	0.031	0.018	0.043	0.030	0.040	0.029	0.021	0.038	0.053	0.004	0.061	0.032	0.006	0.038	0.046	

Notes: Parameter estimates and 90% confidence interval (q.05,q.95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

¹Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.

Table 12: REDUCED FORM REGRESSIONS CORRECTED FOR MEASUREMENT ERROR

End. variables Par.	Dom. Viol.	Cog. Develop.	Lottery choice (y)	Lottery $y \geq 2$	$y \geq 3$	$y \geq 4$	$y \geq 5$	$y \geq 6$	Self- esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	4th wave - 12 year old		
																BMI at 8 years	Daily hours playing	Daily hours studying
HH. Income (2nd wave) q. 05 q. 95	0.002	-0.006	0.013	0.000	0.012	-0.001	-0.008	0.004	0.025	0.006	0.033	-0.042	-0.030	-0.013	0.034	0.004	0.030	0.036
	-0.001	-0.028	-0.001	-0.089	-0.013	-0.068	-0.098	-0.103	-0.093	-0.023	0.002	-0.077	-0.091	-0.049	0.009	-0.038	0.002	0.019
	0.036	0.036	0.057	0.022	0.048	0.022	0.015	0.019	0.027	0.065	0.132	-0.010	-0.008	0.015	0.146	0.051	0.142	0.102
Gender wage gap q. 05 q. 95	0.000	-0.053	0.064	0.070	0.036	0.047	0.049	0.064	0.083	-0.010	-0.153	0.163	-0.069	0.226	-0.015	0.165	-0.076	0.044
	-0.007	-0.096	0.034	0.024	-0.013	0.000	0.005	0.017	0.036	-0.015	-0.204	0.116	-0.115	0.179	-0.068	0.120	-0.126	0.013
	0.001	-0.002	0.092	0.120	0.084	0.098	0.099	0.115	0.131	0.041	-0.101	0.209	-0.022	0.271	0.038	0.214	-0.027	0.075
Cog. Develop. at 5 q. 05 q. 95	0.004	-0.041	0.486	0.021	0.086	0.020	0.020	0.004	-0.012	0.066	0.106	-0.029	-0.023	-0.001	0.019	-0.127	0.049	0.466
	-0.002	-0.134	0.388	-0.067	-0.008	-0.070	-0.070	-0.084	-0.101	-0.001	0.019	-0.116	-0.114	-0.119	-0.068	-0.226	-0.049	0.376
	0.027	0.048	0.579	0.122	0.185	0.120	0.099	0.085	0.122	0.130	0.189	0.062	0.074	0.110	0.105	-0.043	0.141	0.559
Mother's human cap. q. 05 q. 95	0.001	0.054	0.211	0.088	0.040	0.085	0.059	0.102	0.069	0.104	0.047	0.058	0.051	0.172	0.098	0.232	-0.053	0.283
	-0.003	-0.022	0.156	0.021	-0.026	0.016	-0.009	0.029	-0.001	-0.015	-0.006	-0.012	-0.015	0.093	0.037	0.163	-0.116	0.234
	0.004	0.115	0.274	0.163	0.115	0.161	0.135	0.175	0.139	0.149	0.099	0.134	0.119	0.245	0.159	0.295	0.011	0.341
Wealth index q. 05 q. 95	0.002	-0.056	0.244	-0.039	0.003	-0.012	-0.014	-0.052	-0.066	0.067	0.189	-0.099	0.043	0.022	0.163	0.055	0.147	0.168
	0.000	-0.098	0.201	-0.079	-0.036	-0.052	-0.057	-0.093	-0.108	0.039	0.141	-0.144	0.003	-0.022	0.117	0.163	0.101	0.128
	0.024	-0.010	0.282	0.007	0.043	0.032	0.032	-0.005	-0.018	0.094	0.229	-0.056	0.089	0.069	0.204	0.260	0.189	0.202
Household size q. 05 q. 95	0.000	0.022	-0.022	-0.015	-0.026	0.010	-0.014	-0.021	-0.014	-0.032	0.009	0.020	-0.026	0.067	-0.051	0.005	-0.021	-0.002
	-0.001	-0.016	-0.050	-0.055	-0.068	-0.028	-0.055	-0.061	-0.054	-0.056	-0.031	-0.019	-0.065	0.028	-0.092	-0.035	-0.059	-0.032
	0.008	0.055	0.007	0.026	0.015	0.050	0.028	0.020	0.024	-0.009	0.004	0.060	0.014	0.104	-0.013	0.063	0.017	0.026
Two-parents hh. q. 05 q. 95	0.000	0.010	-0.012	-0.010	-0.022	0.004	-0.009	-0.002	-0.016	-0.003	-0.025	0.009	-0.021	0.016	-0.009	-0.024	-0.001	0.019
	-0.001	-0.026	-0.042	-0.048	-0.058	-0.035	-0.049	-0.039	-0.054	-0.026	-0.069	-0.028	-0.055	-0.026	-0.046	-0.066	-0.041	-0.007
	0.005	0.046	0.018	0.026	0.014	0.041	0.029	0.035	0.021	0.020	0.015	0.048	0.014	0.055	0.029	0.016	0.037	0.044

Notes: Parameter estimates and 90% confidence interval (q. 05, q. 95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

¹ Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.

Table 13: IV REGRESSIONS CORRECTED FOR MEASUREMENT ERROR AND CORRECTED SIGNIFICANCE TESTS

	Cog. Develop.	Lottery choice (y)	Lottery choice $y \geq 2$	$y \geq 3$	$y \geq 4$	$y \geq 5$	$y \geq 6$	Self-esteem	Locus of control	BMI at 8 years	Days phys. active	Daily hours sitting	Daily hours playing	Daily hours studying	4th wave - 12 year old		Cog. Develop.
															BMI at 12 years	Daily hours playing	
Par. Investment	1.685	-3.193	3.387	-2.653	-5.869	-4.186	-1.727	9.750	2.927	19.796	-25.413	-10.764	-17.803	15.198	-12.365	17.994	9.614
q.05	-70.203	-89.691	-54.096	-76.110	-98.266	-86.310	-85.924	-43.394	-34.667	-163.969	-330.824	-138.268	-319.301	-113.457	-224.284	-126.232	-79.656
q.95	69.930	83.415	50.816	60.620	65.419	92.612	99.735	100.598	49.350	264.991	154.510	113.980	179.997	212.733	132.468	185.449	93.658
Domestic violence	-1.317	-1.279	-0.653	-0.833	-0.858	-1.203	-1.549	-0.228	0.189	2.821	-3.032	1.294	-4.198	0.220	-3.212	1.493	-0.949
q.05	-5.490	-5.223	-3.223	-3.713	-3.940	-4.859	-6.016	-2.443	-0.683	-1.973	-13.192	-1.271	-17.737	-2.157	-4.208	-2.374	-5.301
q.95	0.937	0.677	0.702	0.744	0.684	0.529	0.559	1.291	1.134	12.037	3.053	5.944	2.668	2.569	3.945	7.124	1.469
Chernozhukov & Hansen significance test																	
H0: Par. Inv. = 0 & Dom. Viol. = 0																	
Smallest est. effect of D.V.	-0.350		0.000	0.000	0.000	-0.100	-0.400	0.000	0.000	1.300	-1.550	0.300	-2.050	0.500	-1.450	0.500	-0.450
Wald test, $\chi(2)$	10.698	6.296	1.826	2.779	2.967	5.754	9.040	4.094	1.627	31.963	37.898	7.538	72.980	8.969	36.660	8.969	11.924
p-value	0.087	0.274	0.752	0.565	0.530	0.306	0.140	0.445	0.758	0.001	0.000	0.190	0.000	0.543	0.000	0.140	0.027
Cog. Develop. at 5	0.402	-0.022	0.046	-0.009	0.001	-0.029	-0.069	0.021	0.054	0.137	-0.064	0.073	-0.114	-0.027	0.044	0.029	0.406
q.05	0.027	-0.346	-0.155	-0.234	-0.253	-0.319	-0.408	-0.113	-0.032	-0.328	-0.766	-0.202	-1.014	-0.198	-0.433	-0.273	0.176
q.95	0.654	0.193	0.203	0.170	0.192	0.184	0.190	0.145	0.163	0.721	0.509	0.394	0.560	0.204	0.821	0.428	0.651
Mother's human cap.	0.251	0.160	0.072	0.132	0.110	0.173	0.155	0.098	0.006	-0.136	0.255	-0.012	0.416	0.071	-0.146	-0.183	0.344
q.05	0.056	-0.006	-0.047	0.001	-0.044	-0.001	-0.059	0.010	-0.057	-0.593	-0.278	-0.313	-0.192	-0.096	-0.734	-0.525	0.160
q.95	0.465	0.391	0.229	0.316	0.304	0.399	0.448	0.250	0.093	0.305	0.757	0.197	1.049	0.285	0.355	0.184	0.661
Wealth index	0.162	-0.109	-0.038	-0.055	-0.053	-0.118	-0.156	0.040	0.040	0.324	-0.222	0.145	-0.172	0.143	0.298	0.187	0.106
q.05	-0.152	-0.392	-0.221	-0.259	-0.276	-0.374	-0.456	-0.116	-0.044	-0.181	-0.822	-0.046	-0.954	-0.074	-0.109	-0.100	-0.128
q.95	0.345	0.071	0.062	0.094	0.110	0.059	0.046	0.139	0.126	0.862	0.271	0.477	0.415	0.332	0.819	0.506	0.268
Household size	-0.002	0.010	-0.010	0.029	0.002	0.001	0.017	-0.024	-0.019	-0.046	0.076	-0.058	0.155	-0.048	-0.023	0.074	0.022
q.05	-0.123	-0.079	-0.087	-0.044	-0.074	-0.090	-0.088	-0.109	-0.073	-0.421	-0.145	-0.207	-0.121	-0.204	-0.334	-0.166	-0.088
q.95	0.121	0.184	0.086	0.161	0.167	0.175	0.212	0.035	0.025	0.181	0.510	0.087	0.663	0.049	0.224	0.450	0.130
Two-parents hh.	0.005	0.001	-0.017	0.010	-0.002	0.009	-0.003	-0.005	0.003	-0.057	0.044	-0.039	0.059	-0.012	-0.065	0.034	0.030
q.05	-0.080	-0.081	-0.075	-0.057	-0.066	-0.063	-0.095	-0.052	-0.042	-0.270	-0.125	-0.169	-0.168	-0.092	-0.306	-0.139	-0.045
q.95	0.137	0.113	0.062	0.096	0.095	0.120	0.128	0.051	0.037	0.111	0.299	0.054	0.393	0.053	0.350	0.082	0.128

Notes: Parameter estimates and 90% confidence interval (q.05,q.95) reported. Confidence intervals calculated using 1,000 bootstrap replications.

¹Variable y is the option chosen in the experiment: Option 1 = 5 tokens for sure, Option 2 = 4 or 10 with equal chance, Option 3 = 3 or 13 with equal chance, Option 4 = 2 or 16 with equal chance, Option 5 = 1 or 19 with equal chance, Option 6 = 0 or 20 with equal chance. Variable $y \geq i$ means that the choice was i or higher for $i \in \{2, 3, 4, 5, 6\}$.