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 grow 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, including lower physical activity and higher BMI.

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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 include 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 poor 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 Savelyev, 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.

The result is important because children make many consequential and unsupervised decisions and these decisions are correlated with their preferences (Bertrand and Pan, 2013; Castillo, Jordan, and Petrie, 2018, 2019; Castillo, Ferraro, Jordan, and Petrie, 2011; Golsteyn, Gronqvist, and Lindahl, 2014; Segal, 2013; Sutter, Kocher, Glaetzle-Ruetzler, and Trautmann, 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. Given the prevalence of domestic violence, knowing the consequences of growing up in a toxic environment on child development is important.

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 in which a child's views, attitudes and capabilities are formed, we know little about how this environment relates to

[1] According 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 activities, verbal aggression, intimidation through destruction of property, harassment or stalking, threats of violence and constant belittling and humiliation.

individual 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 home 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 a negative association with child development. Domestic violence is not only a widespread phenomenon, but it is one that highlights the fact that parents do not always engage in activities that are welfare enhancing for their children.

The findings in this paper are derived from 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 risk attitudes of the children 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 instrument used to measure risk preferences has many desirable characteristics: it applies standardized procedures, children made decisions without parental supervision, and they were paid in tokens that were redeemable for prizes 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 these issues,

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

[3]The study did not collect information on time preferences.

[4]I 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

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 development. This is feasible because of the rich set of data available. To deal with the potential endogeneity of the household environment and parental investment, I follow two strategies.

First, I construct instruments for both parental investments and domestic violence. The instrument for parental investment is based on the introduction of a conditional cash transfer program (CCT) in Peru. Following the approach of Dahl and Lochner (2012) and Gruber and Saez (2002), a simulated instrument of changes in income is constructed using the introduction and deployment timing of the program. To deal with the potential endogeneity of the household environment, I build on Aizer (2010) to construct an instrument for domestic violence based on improvements in the gender wage gap. I confirm that the incidence of domestic violence decreases as the gender wage gap decreases. Using the introduction and timing of the opening of Women Emergency Centers (WECs) across Peru, a second instrument for domestic violence, I show that the timing of WECs is uncorrelated with pre-existing trends in domestic violence but predicts a drop in future levels of domestic violence. Using these constructed instruments in the analysis, I show that growing up in a household where domestic violence occurs leads a child to more risk-averse behavior and slower cognitive development.

Second, I estimate a structural model of child cognitive and preference development. The model is useful because it affords the treatment of both parental investments and domestic violence as endogenous variables. It also allows to model the trade-off between engaging in domestic violence and child development. Following Del Boca, Flinn, and Wiswall (2014), I estimate the model using simulated method of moments. The estimated model captures many of the features of the data, including the impact of domestic violence on risk preferences.

The model estimates show that parents care about both the cognitive development and the risk preferences of their children. Parents act as if they value their child to have the ability to take risks. The model is also helpful in interpreting various results in a coherent framework and allows for policy exercises to assess potential ways to foster balanced development of children. The estimates of the model are broadly in line with those in the literature (e.g Del Boca et al. (2014)). I test the robustness of this model by estimating a second structural model in which husbands use pecuniary and non-pecuniary (violence) to extract effort from their wives. This is a strategic model that follows Weinberg (2001)'s analysis of corporal punishment of children. This model fits the data less precisely than the unitary model, however, it shows that the effect of violence on risk preferences is robust

domestic violence at least once and 3.3% reported it at least twice.

to alternative modelling assumptions. Overall, the constructed instrument and structural modeling approaches show remarkable consistency and robustness of the results.

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 estimated effect can be as large as -0.66SD decrease on the average lottery choice. Also, the measure of domestic violence is associated with a significant decrease in the cognitive development of the child. The estimated effect can be as large as -0.3SD decrease 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. These patterns are also present in the survey given 4 years after the experiment. Increased risk aversion and inactivity point to domestic violence leading to internalizing behaviors.

It is important to note that the effect of domestic violence on children's development and behavior has the potential to be underestimated when addressing measurement and endogeneity issues. This would be consistent with the existence of compensatory behaviors in the household and with domestic violence being equivalent to the absence of parental investment. I present evidence that a composite index of maternal investment that includes investment in time and accounts for domestic violence rationalizes the main patterns in the data.

The emerging picture from this study is that an important component of parenting is providing children a safe home environment. This coincides with the recent literature trying to unpack several components of parental investments (e.g. Aizer and Cunha, 2012; Del Boca et al., 2014). I provide evidence that the effect of domestic violence mimics that of a loss in maternal investment in time and attention. To my knowledge, this is the first paper to show that parents can affect their child's risk preferences and behavior, even if done 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, a possible economic cost of domestic violence would 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, which 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.

The analysis shows that there might be ways to mitigate the prevalence of domestic

violence, such as through the improvement of women's labor prospects (Aizer, 2010) or an increase in the cost of exercising violence against women. Some 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 present estimates using an instrumental variable approach. Section 7 present structural estimations. Section 8 concludes. Additional material is provided in a series of appendices.

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 a 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 later in life (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) observe that the positive relationship between lower socieconomic 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 from 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.

The current literature suggests that children exposed to domestic violence might behave more risk aversely because they experience more stress and/or more uncertainty. The data used in this study do not include measures of stress, however, the prevailing evidence suggests this could be an underlying mechanism for the observed risk-averse behavior.

[5]This effect was found to be larger among men.

[6]Gunnar 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, Pariante, Papadopoulos, Caspi, Moffitt, and Arseneault (2011).

3 Modelling parents decisions and children's preferences

Why would parents engage in behaviors that jeopardize the development of their children if they care about them? In this section, I describe a simple household model in which domestic violence is treated as a consumption good that produces a negative externality. I use this model to motivate the trade-off faced by parents between indulging in potentially harmful habits and aiding the development of their child. This highlights the endogeneity of both parental investments as well as domestic violence. It also stresses that parents always have to make trade-offs between their own consumption and that of their children. Estimates of the model will be discussed Section 7 after presenting estimates of the effect of domestic violence on child outcomes using instrumental variables in Section 6. I will also discuss results using alternative modelling assumptions like the strategic use of domestic violence to extract effort from wives. All approaches lead to similar conclusions.

Parents maximize utility subject to budget and technology constraints. The following program summarizes the decisions of parents:

$$\text{Max}_{C,l_m,l_f,h_m,h_f,\tau_m,V,I}\ \alpha_c ln(C) + \alpha_m ln(l_m) + \alpha_f ln(l_f) + \alpha_V ln(V) + \alpha_\theta ln(\theta_1) + \alpha_\sigma ln(\sigma_1)$$

subject to:

(i) $C + I + p_V V \leq w_m h_m + w_f h_f + Y$

(ii) $T = h_m + l_m + \tau_m$

(iii) $T = h_f + l_f$

(iv) $ln\theta_1 = A + a_\theta ln(\theta_0) + a_{\theta_m} ln(\theta_m) + a_{\tau_m} ln(\tau_m) + a_I log(I) + a_V log(V) + a_X X + \epsilon_\theta$

(v) $ln\sigma_1 = B + b_\sigma ln(\sigma_0) + b_{\theta_m} ln(\theta_m) + b_{\tau_m} ln(\tau_m) + b_I log(I) + b_V log(V) + b_X X + \epsilon_\sigma$

where C is household consumption, I are parental investments in money, Y is predetermined income, l_m is the mother's leisure time and l_f is the father's leisure time, τ_m is the mother's investment in time in the child, h_m is the mother's working hours and h_f is the father's working hours. V is an index of domestic violence, θ_1 is an index of cognitive development at the end of the decision period and θ_0 is a measure of cognitive development at the time decisions are made. σ_1 is a measure of the child's risk-taking behavior at the end of the period and σ_0 is a measure of risk-taking behavior at the beginning of the decision period. In this case, σ_0 is not observed by the researcher. Parents face five constraints, a budget constraint, two time constraints and two technological constraints. The production functions depend on τ_m, I, θ_0, V and a set of additional covariates X.[7]

Some comments about the model specification are in order. First, I assume a Cobb-Douglas utility function and Cobb-Douglas production functions for simplicity. They pro-

[7] In the estimation, X includes an index of mother's capital (θ_m), family size (hh) and wealth (ω).

duce closed-form solutions, and as I will discuss in Section 7, they capture many features of the data. For presentation purposes, I will delay discussion of the estimation of the model until later. Second, domestic violence is modelled as a consumption good. This assumption is strong in the sense that the possibility that violence might be used to extract effort from a spouse is excluded. However, I discuss in Appendix F estimates of a model that allows for the instrumental use of violence, and this yields similar results. I also assume that there is a 'market' for violence. This assumption aims to represent the existence of social costs associated with exercising 'violence' on others (e.g. lost friendships, purchase of presents to repair relationships).

The model makes clear that if parents care about the cognitive development and preferences of their children, parental investments and domestic violence should be considered endogenous variables. This is the basic insight from the economics literature on child development (e.g. Cunha, Heckman, and Schennach, 2010; Heckman et al., 2013). The model also suggests that exogenous variations in income and the cost of exercising domestic violence can help identify the causal impact of both parental investments and domestic violence on children's development. I will present evidence consistent with this prediction in section 6.

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 the survey data.[8]

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

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

In this expression, X_i' represents a set of additional determinants of outcomes and ε_i^k represents factors 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

[8] Attanasio, Meghir, and Nix (2015) use a related approach with the Young Lives sample from 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. Only the survey from Peru has information on domestic violence.

the production of cognitive and non-cognitive abilities. The simplifying assumptions of the model make the estimation tractable, and I discuss the results in light of these assumptions.

4.1 Measurement and Estimation

The model described 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 because the data do not have alternative measures of either risk attitudes 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. Appendix B 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 $\hat{M}^j_{m_j}, m_j \in \mathcal{M}_j$ for each of the latent factors $j \in \mathcal{I}$. Measures are standardized, and the basic measurement equation is:

$$\hat{M}^j_{m_j} = \lambda^j_{m_j}\theta^j + \varepsilon^j_{m_j}, j \in \mathcal{I}, m_j \in \mathcal{M}_j \tag{2}$$

I further assume that latent variables are zero mean with covariance matrix Σ and that $COV(\varepsilon^j_{m_j}, \varepsilon^k_{m_k}) = 0$, all $j, k \in \mathcal{I}, m_j \in \mathcal{M}_j, m_k \in \mathcal{M}_k$. That is, I assume that the noise terms are uncorrelated for all measures. Under the additional normalization assumption that $\lambda^j_1 = 1$ 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 three 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:

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

[9] In 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.

This formula is used in the analysis.

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 to over-represent poor districts. Each of the remaining districts was subdivided in geographical areas of similar population size and then 20 of these units were selected for the study. Each of these 20 units was further subdivided into 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 100 eligible households were surveyed. Escobal and Flores (2008) 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) document 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 tokens were redeemable for prizes (i.e. 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 is a sure payment. Then, to distinguish between risk neutral and risk taking children, the last option only increased the variance of the lottery but keeps the

expected payoff constant. Figure 2 shows the distribution of lottery choices for boys and girls (panel a) and the distribution of lottery choices 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% of the adults in the household were grand or great-grand parents and 17% percent were other adults (i.e. 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 includes a question on whether the mother ever asks for help due to domestic violence problems. Twelve and a half percent responded in the affirmative. This variable will be used as an additional measure of domestic violence. Finally, the presence of smokers (other than the mother) will also be used as an additional indicator of the quality of the home 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 de-

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

[11] The correlation between the answer to the domestic violence question 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).

pression. 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 compared to 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 reported instances of domestic violence is negatively correlated with the mother's years of education ($r = -0.09$, p-value < 0.001), the 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 recent experience of a bad shock ($r = 0.06$, p-value $= 0.009$). Similar results are obtained using the disaggregated reported 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 match with a picture. The questions increase in the level of difficulty as the test progresses. 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) provide detailed information on the validity of all tests for the current sample of children. For comparison, results on similar samples of chidren 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) devel-

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

oped 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 in 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 poor reading skills would not impact the test. The second section of the test measures the ability to perform basic mathematics operations with numbers (i.e. 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 zero. 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 0.697. Factor analysis confirms that 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 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 a 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).

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 later surveys include the average time per 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.

5.5 Instrumental variables

The theory section suggests that, conditional on wealth and family structure, variations in current income and the cost of domestic violence should influence parental investment and domestic violence. I follow Dahl and Lochner (2012) and Gruber and Saez (2002) to construct a simulated instrument of change in income due to the introduction and timing of deployment of a conditional cash transfer (CCT) program in poor areas of Peru. The CCT program started in 2005 and was deployed in phases according to overall poverty levels. The CCT program defined eligibility using a known formula which was based on family characteristics (the actual formula used for eligibility is presented in Appendix B).[14] Since families could potentially manipulate their characteristics and location in order to qualify for the program, I calculate eligibility based on the characteristics of the household at the time of the first wave of the Young Lives (YL) study. The YL study started several years prior to policy discussions leading to the CCT program which makes calculations based on lagged variables less susceptible to manipulation.

Due to the timing of the policy, mainly after the second wave of the YL study, I can simulate changes in income between the second and third wave.[15] In particular, I use income in the second wave and the wealth index in the first wave of the YL study to

[13]The 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?"

[14]Conditions varied by the age of participant. Members of households with children younger than five years of age or with a pregnant or lactating woman present were required to attend regular health care visits. Children aged 6 to 14 years old who had not completed primary school were required to attend school 85% of school days. Beneficiary households received transfers of 100 soles (about US$30) each month regardless of household composition, representing ∼15% of household spending (Andersen, Reynolds, Behrman, Crookston, Dearden, Escobal, Mani, Sanchez, Stein, and Femald, 2015)

[15]Unfortunately, I cannot calculate changes in income between the first and later rounds of the YL since data on income were not collected in the first round.

predict pre-CCT income in the third wave. I use a fifth-order polynomial of the second wave income, a dummy variable for reporting zero income and the wealth index in the first wave to predict pre-transfer income in the third wave (as in Dahl and Lochner (2012)). I use the simulated eligibility, based on the actual formula by the Peruvian government and household characteristics in the first wave of the panel, and the deployment schedule of the CCT, to predict whether a family would have received a transfer. The predicted income plus the predicted transfer are used to calculate a predicted income in the third wave of the study. Predicted changes in income across waves are calculated by subtracting the income in the second wave from the predicted income in the third wave.

The predicted change in income is used as an instrument for parental investment. Predicted changes in income are less likely to be correlated with pre-existence differences across sites which in turn are correlated with the CCT deployment schedule.[16] In the estimations, I augment the set of controls by including a polynomial of second wave income and whether the family reported no income in the second wave of the study. I do this to reduce biases due to factors such as measurement error, regression to the mean, and serially correlated income (see Dahl and Lochner (2012)). Finally, I also include the value of the eligibility index to make sure that the results are due to changes in income and not due to eligibility. Credibility of this instrument is anchored by pre-CCT program variables and the fact that they are unlikely to correlate with anticipated shocks. The main drawback of the variable is its conditionality. However, the CCT program would be expected to overestimate the effect of parental investment because the conditionality was based on parents providing more investment (e.g. increased schooling). If domestic violence is significant because it is picking up parental investment, then this approach should make that explanation less plausible.

To account for changes in the bargaining position of women, I construct a measure of the gender wage gap. 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 (ENAHO) collects information from a random sample of 2,200 households every month in order to assess living standards. The 2009 sample included 26,988 household and 17,285 individual observations on wages.[17] To diminish the possibility that local characteristics influence local wages, I use the average of a neighboring province in the calculation of both men and women's wages. This reduces the chances that local prevailing levels of violence against women manifest themselves as lower wages due to productivity losses.

I also consider a second instrument for domestic violence: whether a Woman Emergency Center (WEC) was opened in the YL site between 2005 and 2008 (prior to the 3rd wave

[16]The estimations are robust to the inclusion of site-level average wealth level.

[17]There is a community survey associated with the Young Lives study that contains some information on wages. However, this information is collected from informants, and it is selective and incomplete.

of the survey). I do this because recent research showing the effect of WEC in reducing domestic violence in Peru (Trako, Sviatschi, and Kavanaugh, 2018) and my conversations with officials at the Peruvian Ministry of Women and Disadvantage Populations suggest that the WECs were not opened in response to changes in cases of domestic violence but rather because of the availability of space for a center. Table A.1 in Appendix A uses several Peruvian Demographic and Health Surveys (DHS) to show that past levels of domestic violence do not predict the creation of WECs. There is no consecutive yearly DHS data prior to 2004, so the estimations use data from year 2004 onwards. In the estimations, I use changes in the availability of a WEC, rather than the existence of a WEC, to reduce the potential influence of pre-existing differences across sites.

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.

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 latent variable measure. 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, domestic violence and the 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 and is discussed further in Section 6.4, I find that at most one latent factor exists. The largest eigenvalue is 2.25 (second largest 0.40) for the measures of cognitive development at age 8, 2.11 (second largest 0.49) for cognitive development at age 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 age 5, and 1.98 (second largest 0.59) for mother's capital.[18]

[18]These calculations are performed after the effects of age, sex and location have been removed from each measure.

6.2 Preliminary results

Table 4 presents correlation coefficients between the lottery decision, indices of the mother's psychological malaise and an indicator variable that equals 1 if the child had a serious injury (e.g. burns, broken bones, etc.).[19] 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 wave 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. 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, the mother's wellbeing and the child's development are not due to omitted time-invariant variables. While this is suggestive that the relationship between domestic violence and child development is not spurious, 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. Results that address the issue of endogeneity are presented next.

6.3 Instrumental variable estimates

This section presents the IV regressions of the effect of parental investments and domestic violence on the child outcomes of interest. Table 6 shows the first- and second-stage regressions for cognitive development and lottery choice for completeness.[20] Predicted changes in income strongly predict parental investment and the gender wage ratio, and the introduc-

[19] The 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.

[20] As discussed in Appendix B, parameter estimates might be biased due to measurement error. The estimates presented in the paper do not correct for this possibility for clarity of exposition and due to the fact that the results are similar if a correction is used.

tion of a WEC predict a reduction in the prevalence of domestic violence. The instrumental variable approach helps uncover the importance of parental investments but also shows that the effect of intimate partner violence is robust. The identified effect of domestic violence does not appear to be due to an underestimation of the effect of parental investment.

Tables A.2 and A.3 in Appendix A show the effect of domestic violence first, and domestic violence and parental investment second, using simulated changes in income, province-level female-male wage gaps and whether a WEC was opened, for a larger set of outcomes. These tables 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.

Table A.4 presents the estimates excluding the change in the presence of a WEC as an instrument. The results are similar, but they are less precisely estimated. Table A.5 presents the estimates on the subsample of households that would have likely qualified for a CCT if the program was universal at the time of its inception. This provides a comparison group closer to those predicted to receive a CCT earlier. Because the threshold used to assign CCTs was significantly lower after 2007 and the qualification process was relaxed to make it easier to receive a transfer, I use a lower threshold than the original one (0.600 instead of 0.756). Table A.5 shows that the results are comparable despite the loss of power. Finally, Table A.6 in Appendix A compares the coefficient estimates of the equation for cognitive development and lottery decisions accounting for measurement error. Measurement error occurs due to the fact that estimated latent variables are only approximations. Formulas to correct for this bias in the IV regressions are provided in Appendix B. Parameter estimates are very close to the estimates without the measurement error correction suggesting that measurement error is not severe in the sample.

In sum, the estimates using instrumental variables point to a direct effect of domestic violence on cognitive development and risk aversion that is separate from parental investments.

6.4 Domestic violence and parental investments

The measure of parental investment combines both time and money investments. Del Boca et al. (2014) have shown that parental investment of time and money are different and not equally effective. It stands to reason that more refined measures of parental investments might explain child outcomes better. Table A.7 shows confirmatory factor analysis conducted on the measures of monetary parental investment, time investment and domestic violence. Importantly, the analysis shows that these are three different concepts. I next estimate the effect of investment of time and domestic violence on cognitive development

and risk attitudes separately.

Table A.8 shows the negative symmetry between parental investment in time and domestic violence. Empirically, however, I find that variables affecting a mother's investment in time also affect the presence of domestic violence. In other words, it is not possible to identify simultaneously the separate effect of investments of time and domestic violence given the data. Figure A.1 uses the approach suggested by Chernozhukov and Hansen (2008a) to identify the set of parameters for parental investment of time and domestic violence that is not rejected by the data.[21] Figure A.1 shows that for both cognitive development and lottery choices, the hypothesis that the coefficients of both parental investment in time and domestic violence are simultaneously equal to zero can be rejected.

This analysis suggests creating a *domestic violence adjusted* index of parental investment in time. In particular, I construct such an indicator by simply subtracting the index of domestic violence from the index of parental investment in time. This particular assumption is consistent with the estimates presented in Figure A.1. Table A.9 shows regression results using this indicator and an indicator of parental investment of money. I follow the instrumental variable approach described in the previous sections. Table A.9 shows that parental investment of time minus domestic violence consistently affects indicators of child development and behavior. For instance, a one-standard deviation in the domestic violence adjusted index of mother's investment of time leads to approximately a 0.4SD increase in the cognitive development index and a 0.6SD increase in the lottery choice. While this is suggestive that one mechanism through which domestic violence affects children is by diminishing the effect of mothers' time investments, other combinations of these two indicators are not rejected by the data either.

This analysis suggests that identifying the effect of domestic violence separate from the complexity of parental investments is challenging. This would amount to finding instrumental variables that affect domestic violence but do not affect any of the instances of parental investment. The next section addresses this identification problem by estimating a structural model in which parental investments of different types and domestic violence are endogenous. The structural approach provides evidence that both mothers' investments of time and money and domestic violence are both consequential for the development of a child. While structural estimates depend heavily on function form assumptions, they provide support for the idea of adjusting measures of parental investments by the presence of domestic violence.

[21] I discuss this approach in Appendix B

7 Structural Estimates

In this section, I discuss the estimation of a structural household model in which parental investments and domestic violence are endogenous. As mentioned in Section 3, I assume a Cobb-Douglas utility function and Cobb-Douglas production functions for simplicity. I also assume that there is a 'market' for violence. This assumption aims to represent the existence of social costs associated with exercising 'violence' on others (e.g. lost friendships and purchase of presents to repair relationships). Finally, it is clear from the model that if domestic violence has a negative effect on the development of the child, parents will never engage in violence if parameter $|\alpha_V|$, the utility from domestic violence, is smaller than $|\alpha_\theta a_V + \alpha_\sigma b_V|$, the utility-weighted loss in child development. In the estimation, I assume that the utility parameter for violence has a lower bound. This is equivalent to assuming that parents will refrain from violence if it is too harmful, but there is always a remnant demand for 'violence' that is unavoidable.

Preference parameters α_i are assumed to be positive and add up to one. To model heterogeneity in preferences, and therefore heterogeneity in behavior, it is assumed that they are drawn from a multivariate distribution.[22] The log of wages are assumed to depend on years of education and age. Predetermined income is assumed to be random, and bounded from below at zero, which is largely consistent with the data. The price of violence p_V is assumed to depend on the education of the parents. All income related processes are allowed to be correlated. The parameters of the cognitive development and risk preferences equation are assumed to be fixed and equal for all households. In this model, parental investments and domestic violence are endogenous, and their level depends on how much parents care about their child's cognitive ability and risk attitudes. The model allows for the presence of domestic violence to be negatively correlated with parental investments due to preferences and not due to their impact on child development or preferences. Ex-ante, the model does not assume that parents care about their child's preferences or that domestic violence harms their development.

The model is estimated using the simulated method of moments. For a given set of parameters, 50 random draws are obtained for each household, decisions are calculated according to the value of these draws and moments of the simulated data are then calculated. Moments are weighted by the inverse of the estimated variance of the sample moments. The list of moments used in the estimation and the fit of the different moments are presented in Appendix D. The model is estimated in the subset of families with two parents present to

[22] I follow Del Boca et al. (2014) in specifying preference parameters. In particular, I assume that $\alpha_i = \frac{exp(\kappa_i)}{\sum_j exp(\kappa_j)}$, and $\kappa \sim N(\mu, \Sigma)$

simplify the analysis.[23] Domestic violence is more likely to occur in these households (18% ever reporting domestic violence versus 11%) and most households are couples (87%). All the flow variables are defined in weekly terms.

Estimation of the household model requires observing maternal investments of time. Due to data limitations, this variable is proxied by the addition of the time a child is reported doing homework and the time that it takes to get the child to school. Both these variables are taken from the second wave of the study. These variables are used as a proxy of maternal time investments because the study time of a five year old child is mostly supervised by mothers and mothers are likely to take the child to school.[24] To improve identification of maternal time investments, the model is augmented by making additional measures of maternal time investments depend on this proxy variable. In particular, the responses to the questions 'Do you help your child with homework?', 'Do you know the names of your child's friends?' and 'Do you encourage your child to read?' are modelled as a function of maternal time investment. This approach mimics the construction of the parental investment index in the Section 6.4.

Utility is defined by the amount of domestic violence consumed. This consumption is assumed to be a latent variable that manifests itself in different measures, such as reporting incidents of domestic violence or asking for help due to domestic violence. This is, indeed, the assumption already made in the paper through the construction of an indicator of domestic violence from different variables. The difference is that the parameters of the factor model are estimated simultaneously with the rest of the household parameters. Additional advantages of this exercise are that these indicators are explicitly modelled as dichotomous variables and that discrete and continuous variables can be handled using single index models. Because domestic violence is a latent variable, the mean price of violence p_V is assumed to be one. This provides a scale for the domestic violence latent factor and allows for identification of the preference parameter for violence. Finally, the structural model allows lottery choices to be modelled as an ordered probit which is a function of latent risk preferences. That is, the structural model provides a consistent framework to accommodate continuous and discrete measures.

Table E.2 in Appendix D shows the fit of the model for the 120 moments used to calibrate it. The model is able to reproduce many features of the data and the variables used in the analysis. For instance, the model captures the prevalence of domestic violence and behavior in the lottery experiment as well as the cognitive development of the child. Due to the presence of outliers in the earning variables, these variables follow the empirical

[23] A complete model would require modelling the decision to form a two-parent household.

[24] This is confirmed in the data.

moments less closely. This suggests that using quantiles of these variables might produce more robust estimates. Figure 3 compares the simulated and observed distributions of the cognitive development index. The model follows the main patterns of this variable closely.

Table 7 presents estimates of preference parameters and the cognitive development and risk attitudes functions. Parents seem to care about both the cognitive development and the risk attitudes of their children. The sum of the weight of these two elements exceeds that of consumption. The estimates also suggest that there is a high degree of preference heterogeneity as expressed by the coefficient of variation of the preference parameters. Regarding cognitive development, the model estimates suggest that both parental investment of time and money are important inputs. The negative effect of domestic violence on cognitive development at age 8 is estimated to be small. Regarding the risk attitudes of children, the estimates confirms that domestic violence has a negative effect on risk taking behavior. Parental investment seems to have a relatively small effect on risk attitudes. These results should be taken with caution since they depend on the assumptions made on preferences, technology and household dynamics. It is possible that domestic violence affects cognitive development at earlier ages when the role of schooling is less important and because parental investment might affect preferences at earlier ages as well. To identify these possibilities, the model would have to be extended to earlier periods. This would be challenging, however, due to data limitations.

The structural model exercise confirms that domestic violence is not capturing parental investments only. The model could be extended in several directions. One direction is to allow complementarities in the production function. A second direction is to look at the dynamics of domestic violence and development using all waves of the Young Lives study. That might afford identification of the effect of household environment at earlier and later years. The model can also be extended to include other measures of child development like physical health and self-assessments.

To test the robustness of the results, Appendix E discusses an alternative model of household decisions which is hierarchical. The model assumes that *altruistic* husbands might use violence as a way to extract effort from their wives whenever they cannot afford non-violent incentives. Being altruistic, husbands consider the trade-off of extracting labor and decreasing the wellbeing of their wives and their offsprings. Estimates of this model fit the data less well, but they confirm that domestic violence is deleterious to child development.

In sum, the structural estimation exercise supports the idea that parents care about their child's preferences as they do about their cognitive development. A potential reason for this is that risk attitudes are associated with other aspects of a child's development that are not captured by cognitive measures.

8 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 a child's cognitive development is negatively associated with domestic violence, and I provide evidence that this effect is causal. I also find that the presence of domestic violence in a household early in a child's life is associated with the manifestation of more risk averse behavior. While domestic violence affects cognitive development and risk attitudes separately, they are not correlated. That is, bad early life experiences, such as living in a household with domestic violence, can have multiple and separate effects. Structural estimation of a household model with domestic violence reveals that parents behave as if they care about not only their child's cognitive development but also her preferences. Parents seem to favor risk taking behavior during childhood.

Some research shows that exposure to domestic violence during childhood increases the likelihood of committing crimes and engaging in risky activities as an adult (Carrell and Hoekstra, 2010; Currie and Tekin, 2006). I find instead that children who grew up in a household 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, through its effect on cognitive abilities and household dynamics, and this could drive crime and risky behavior as an adult (Freeman, 1999). The findings of this paper combined with previous results highlight the complementarity of experimental and survey methods in the identification of why past experiences affect future behavior.

Recent evidence shows 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 a child's household conditions might be a necessary complement for the success of interventions at the school level.

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Figure 1: Lottery Instrument

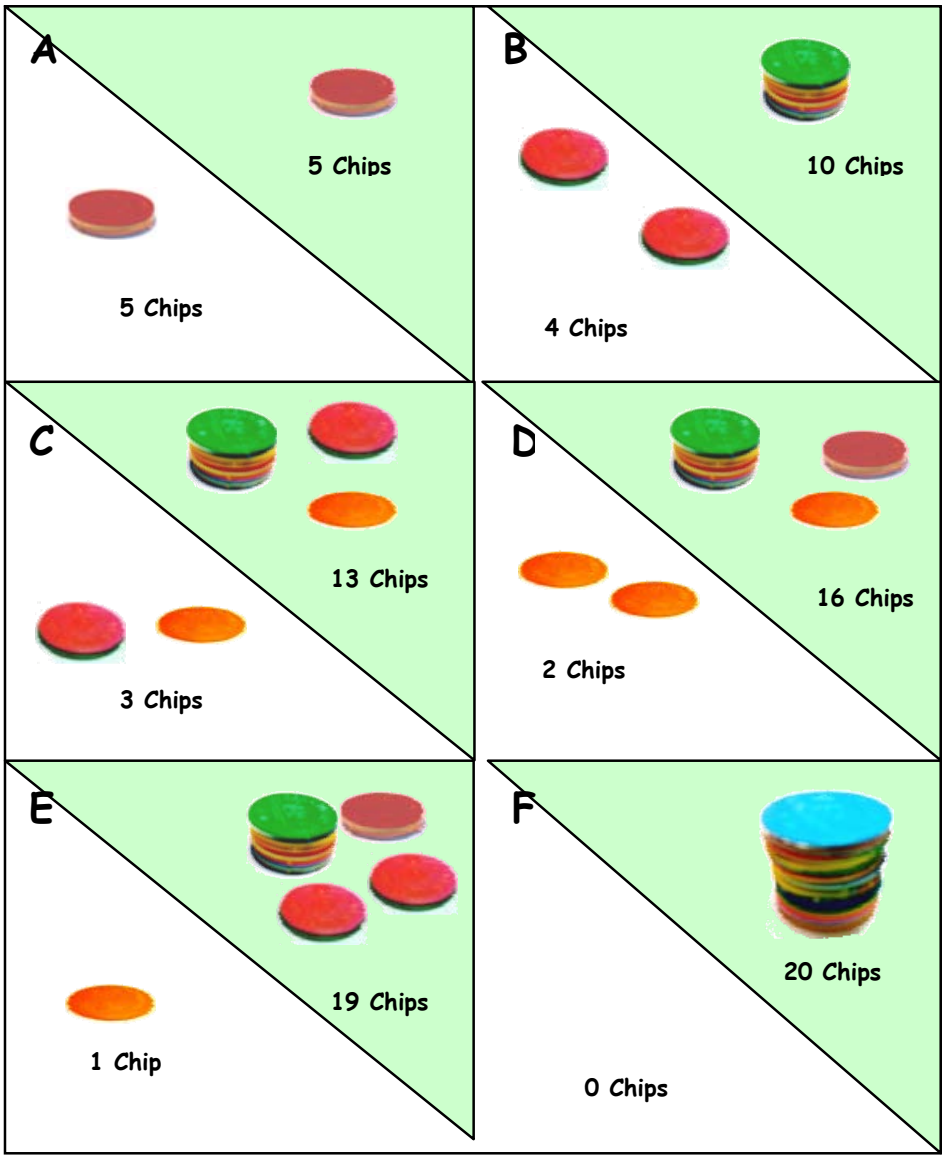
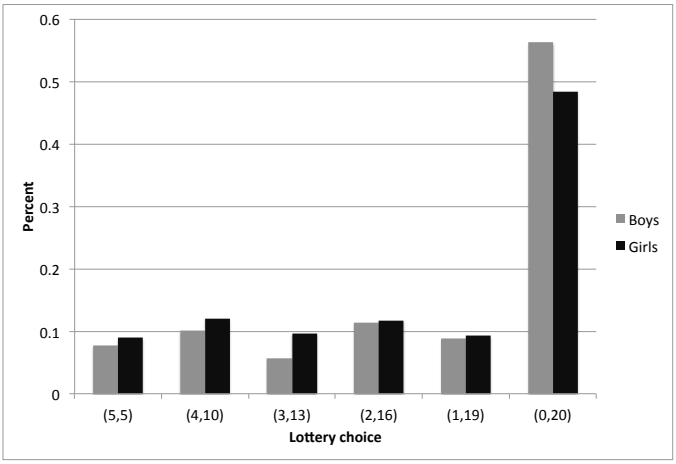
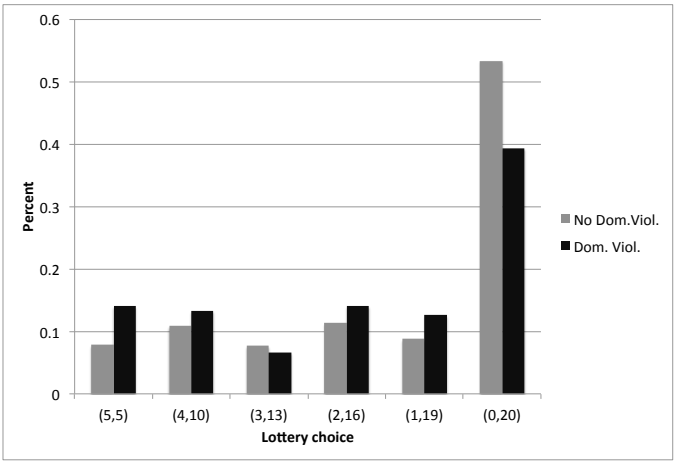


Figure 2: Distribution of lottery choices



(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 school level (category)	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 variance explained by latent variable
Gognitive ability at 12 (4th round)	
Peabody test (4th survey)	0.478
Math knowledge exam	0.549
Early grade reading assessment	0.645
Gognitive 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
Gognitive 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	y_2	y_3	y_4	y_5	y_6	Wave 1	Wave 2	Wave 3	Wave 4	Wave 1	Wave 2	Wave 3
y	1.000												
y_2	0.629***	1.000											
	(0.000)												
y_3	0.847***	0.628***	1.000										
	(0.000)	(0.000)											
y_4	0.905***	0.512***	0.816***	1.000									
	(0.000)	(0.000)	(0.000)										
y_5	0.902***	0.394***	0.627***	0.769***	1.000								
	(0.000)	(0.000)	(0.000)	(0.000)									
y_6	0.833***	0.323***	0.515***	0.631***	0.821***	1.000							
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)								
Mother's psych. malaise index (wave 1)	0.015	-0.003	-0.016	0.019	0.028	0.024	1.000						
	(0.559)	(0.892)	(0.530)	(0.458)	(0.271)	(0.359)							
Mother's psych. malaise index (wave 2)	-0.025	-0.041	-0.014	-0.012	-0.017	-0.026	0.288***	1.000					
	(0.336)	(0.111)	(0.599)	(0.629)	(0.508)	(0.309)	(0.000)						
Mother's psych. malaise index (wave 3)	0.004	-0.024	-0.006	0.017	0.006	0.012	0.169***	0.166***	1.000				
	(0.873)	(0.347)	(0.825)	(0.506)	(0.821)	(0.643)	(0.000)	(0.000)					
Mother's psych. malaise index (wave 4)	0.011	0.021	0.014	0.008	0.013	-0.004	0.346***	0.257***	0.224***	1.000			
	(0.672)	(0.418)	(0.580)	(0.764)	(0.626)	(0.891)	(0.000)	(0.000)	(0.000)				
Serious injury (wave 1)	-0.047*	-0.042*	-0.039	-0.026	-0.030	-0.057**	0.153***	0.039	0.058**	0.054**	1.000		
	(0.070)	(0.099)	(0.129)	(0.304)	(0.243)	(0.026)	(0.000)	(0.134)	(0.024)	(0.034)			
Serious injury (wave 2)	0.014	-0.014	0.001	0.026	0.032	0.003	0.052**	0.064**	0.059**	0.034	0.067***	1.000	
	(0.576)	(0.589)	(0.957)	(0.305)	(0.216)	(0.894)	(0.043)	(0.013)	(0.022)	(0.188)	(0.009)		
Serious injury (wave 3)	0.015	-0.028	0.000	0.013	0.027	0.030	0.036	0.036	0.045*	0.051**	-0.003	0.076***	1.000
	(0.565)	(0.280)	(0.996)	(0.606)	(0.290)	(0.242)	(0.161)	(0.162)	(0.080)	(0.046)	(0.914)	(0.003)	
Female	-0.063**	-0.013	-0.031	-0.062**	-0.067***	-0.072***	-0.016	0.030	-0.009	-0.023	-0.004	-0.094***	-0.102***
	(0.014)	(0.625)	(0.236)	(0.017)	(0.009)	(0.005)	(0.546)	(0.238)	(0.714)	(0.365)	(0.883)	(0.000)	(0.000)
Domestic violence reported (wave 1)	-0.017	0.000	-0.026	-0.005	-0.016	-0.018	0.143***	0.060**	0.060**	0.111***	-0.005	-0.024	-0.020
	(0.516)	(0.988)	(0.316)	(0.846)	(0.523)	(0.482)	(0.000)	(0.020)	(0.019)	(0.000)	(0.839)	(0.349)	(0.435)
Domestic violence reported (wave 2)	-0.044*	-0.079***	-0.037	-0.028	-0.031	-0.026	0.029	0.100***	0.049*	0.073***	0.007	-0.005	-0.014
	(0.088)	(0.002)	(0.155)	(0.271)	(0.230)	(0.309)	(0.258)	(0.000)	(0.056)	(0.004)	(0.779)	(0.849)	(0.577)
Domestic violence reported (wave 3)	-0.059**	-0.060**	-0.039	-0.028	-0.046*	-0.075***	0.079***	0.082***	0.098***	0.122***	0.050*	0.013	0.033
	(0.021)	(0.019)	(0.134)	(0.275)	(0.071)	(0.004)	(0.002)	(0.001)	(0.000)	(0.000)	(0.052)	(0.603)	(0.205)
Child cognitive development (wave 3)	-0.035	0.009	-0.019	-0.042	-0.046*	-0.033	-0.039	-0.053**	-0.073***	-0.099***	0.019	0.003	0.032
	(0.169)	(0.715)	(0.453)	(0.101)	(0.073)	(0.198)	(0.129)	(0.040)	(0.004)	(0.000)	(0.470)	(0.908)	(0.216)
Child cognitive development (wave 2)	-0.018	0.034	-0.005	-0.008	-0.025	-0.045*	0.002	-0.079***	0.000	0.002	0.020	0.029	-0.016
	(0.496)	(0.191)	(0.833)	(0.751)	(0.326)	(0.080)	(0.945)	(0.002)	(0.986)	(0.923)	(0.445)	(0.252)	(0.528)
Mother's capital	0.019	0.050*	0.030	-0.005	0.013	0.006	-0.104***	-0.016	-0.057**	-0.087***	-0.011	-0.011	0.016
	(0.471)	(0.052)	(0.249)	(0.833)	(0.603)	(0.826)	(0.000)	(0.547)	(0.028)	(0.001)	(0.670)	(0.659)	(0.533)
Reasons with child when misbehaves (wave 2)	-0.074***	0.003	-0.056**	-0.099***	-0.066**	-0.066**	-0.012	-0.017	-0.041	-0.028	0.008	0.009	0.009
	(0.004)	(0.896)	(0.031)	(0.000)	(0.010)	(0.010)	(0.652)	(0.504)	(0.108)	(0.284)	(0.765)	(0.729)	(0.725)
Reasons with child when misbehaves (wave 3)	-0.056**	-0.015	-0.041	-0.065**	-0.054**	-0.048*	-0.006	0.026	-0.063**	-0.015	0.013	-0.008	0.016
	(0.029)	(0.560)	(0.109)	(0.012)	(0.035)	(0.062)	(0.829)	(0.320)	(0.014)	(0.558)	(0.621)	(0.750)	(0.536)
Corporal punishment if child misbehaves (wave 2)	0.086***	0.033	0.064**	0.084***	0.080***	0.084***	0.052**	0.031	0.062**	0.025	0.023	-0.031	-0.006
	(0.001)	(0.205)	(0.012)	(0.001)	(0.002)	(0.001)	(0.044)	(0.227)	(0.017)	(0.335)	(0.363)	(0.232)	(0.804)
Corporal punishment if child misbehaves (wave 2)	0.051**	0.002	0.042	0.041	0.048*	0.062**	0.006	0.067**	0.021	0.034	0.035	0.042	0.016
	(0.049)	(0.944)	(0.103)	(0.113)	(0.060)	(0.016)	(0.826)	(0.010)	(0.419)	(0.193)	(0.174)	(0.106)	(0.527)
Excessive drinking (wave 1)	-0.027	-0.029	-0.019	-0.026	-0.021	-0.020	0.004	0.023	-0.015	0.023	-0.014	0.007	0.003
	(0.293)	(0.263)	(0.455)	(0.306)	(0.409)	(0.430)	(0.871)	(0.363)	(0.549)	(0.374)	(0.591)	(0.791)	(0.910)
Excessive drinking (wave 2)	-0.023	-0.031	-0.012	-0.010	-0.018	-0.027	0.026	0.097***	-0.002	0.004	0.026	-0.021	0.007
	(0.375)	(0.226)	(0.630)	(0.698)	(0.490)	(0.290)	(0.321)	(0.000)	(0.945)	(0.883)	(0.314)	(0.411)	(0.798)
Excessive drinking (wave 3)	-0.026	-0.046*	0.002	-0.009	-0.018	-0.041	0.013	0.053**	0.078***	0.061**	0.027	0.006	0.053**
	(0.319)	(0.073)	(0.946)	(0.729)	(0.494)	(0.110)	(0.621)	(0.040)	(0.002)	(0.017)	(0.292)	(0.813)	(0.038)
No. of smokers in household (wave 2)	0.010	0.002	0.007	0.007	0.013	0.012	-0.007	0.004	0.007	-0.011	0.046*	0.031	-0.010
	(0.684)	(0.948)	(0.777)	(0.787)	(0.615)	(0.652)	(0.776)	(0.870)	(0.800)	(0.667)	(0.077)	(0.222)	(0.687)
No. of smokers in household (wave 3)	0.006	0.003	0.007	0.006	0.007	0.002	0.043*	0.077***	0.043*	0.009	0.053**	0.035	0.027
	(0.803)	(0.897)	(0.783)	(0.801)	(0.772)	(0.932)	(0.096)	(0.003)	(0.094)	(0.725)	(0.039)	(0.175)	(0.295)
Searched for help (wave 3)	-0.006	-0.009	-0.013	0.001	0.004	-0.011	0.091***	0.045*	0.160***	0.102***	0.107***	0.016	0.010
	(0.808)	(0.732)	(0.612)	(0.983)	(0.886)	(0.674)	(0.000)	(0.084)	(0.000)	(0.000)	(0.000)	(0.536)	(0.705)
Wealth index (wave 3)	-0.077***	-0.002	-0.039	-0.051**	-0.086***	-0.113***	-0.046*	-0.128***	-0.060**	-0.071***	0.004	0.054**	0.062**
	(0.003)	(0.937)	(0.133)	(0.049)	(0.001)	(0.000)	(0.071)	(0.000)	(0.019)	(0.006)	(0.876)	(0.036)	(0.016)

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

	Mother's psych. malaise		Child			
	All	First	had serious		Cognitive	
VARIABLES	data	3 surveys	injury		Development	
Domestic violence reported		0.076***	0.002	-0.002	-0.164***	-0.153***
		[0.023]	[0.020]	[0.021]	[0.056]	[0.057]
		(0.001)	(0.929)	(0.917)	(0.004)	(0.008)
Mother's psych. malaise				0.029**		-0.105***
				[0.015]		[0.037]
				(0.046)		(0.004)
HH per-capita consumption	-0.000	0.000	0.000	0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
	(0.962)	(0.963)	(0.952)	(0.993)	(0.876)	(0.838)
Wealth index	-0.167***	-0.242***	-0.136***	-0.135***	0.057	0.034
	[0.032]	[0.046]	[0.041]	[0.042]	[0.129]	[0.131]
	(0.000)	(0.000)	(0.001)	(0.001)	(0.658)	(0.798)
Constant	0.098***	0.128***	0.168***	0.167***	0.009	0.023
	[0.017]	[0.023]	[0.020]	[0.020]	[0.069]	[0.070]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.895)	(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

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: First and second stage IV regressions for cognitive development and lottery choices

	Cog. Dev. (wave 3)			Lottery Choice		
	1st Stage			1st Stage		
	Parental Investment	Dom. Viol Index	Cog. Develp.	Parental Investment	Dom. Viol Index	Lot. Choice
Simulated change in income	0.547***	0.124		0.536***	0.141	
	[0.080]	[0.123]		[0.077]	[0.121]	
	(0.000)	(0.316)		(0.000)	(0.246)	
Wage gap	0.042**	-0.057**		0.039**	-0.057**	
	[0.017]	[0.027]		[0.016]	[0.026]	
	(0.015)	(0.033)		(0.017)	(0.027)	
Opening of Women Emergency Center	0.014	-0.078***		0.010	-0.062***	
	[0.015]	[0.023]		[0.014]	[0.022]	
	(0.363)	(0.001)		(0.468)	(0.005)	
Parental investments	.		0.349**	.		0.218
			[0.172]			[0.283]
			(0.043)			(0.442)
DV index		.	-0.339*		.	-0.733**
			[0.196]			[0.345]
			(0.084)			(0.033)
Cog. development (w. 2)	0.118***	-0.054	0.383***	0.127***	-0.041	-0.025
	[0.029]	[0.045]	[0.043]	[0.026]	[0.041]	[0.067]
	(0.000)	(0.232)	(0.000)	(0.000)	(0.322)	(0.709)
Mother's capital	0.048**	0.045	0.230***	0.031	0.059*	0.102**
	[0.023]	[0.036]	[0.030]	[0.019]	[0.030]	[0.041]
	(0.038)	(0.208)	(0.000)	(0.107)	(0.050)	(0.013)
Wealth index (w. 1)	-0.104***	0.034	0.155***	-0.098***	0.026	0.034
	[0.031]	[0.048]	[0.039]	[0.028]	[0.045]	[0.059]
	(0.001)	(0.480)	(0.000)	(0.001)	(0.556)	(0.567)
Family size	-0.028*	0.011	-0.028	-0.021	0.018	-0.002
	[0.015]	[0.023]	[0.019]	[0.014]	[0.021]	[0.029]
	(0.059)	(0.615)	(0.129)	(0.125)	(0.404)	(0.938)
Two-parent HH	0.029**	0.019	-0.013	0.027**	0.009	-0.011
	[0.015]	[0.023]	[0.019]	[0.014]	[0.021]	[0.029]
	(0.047)	(0.396)	(0.505)	(0.046)	(0.670)	(0.713)
Income (w. 2)	0.638***	0.087	-0.012	0.627***	0.111	-0.070
	[0.065]	[0.100]	[0.053]	[0.062]	[0.097]	[0.087]
	(0.000)	(0.382)	(0.817)	(0.000)	(0.256)	(0.421)
Income sq. (w. 2)	-0.021	0.035	0.008	-0.021	0.030	0.072
	[0.036]	[0.056]	[0.046]	[0.035]	[0.055]	[0.075]
	(0.564)	(0.536)	(0.861)	(0.546)	(0.586)	(0.340)
No income reported (w. 2)	0.028	-0.003	-0.036	0.029	-0.003	0.103*
	[0.029]	[0.044]	[0.035]	[0.028]	[0.044]	[0.057]
	(0.324)	(0.939)	(0.302)	(0.287)	(0.947)	(0.069)
Proxy means test for CCT	-0.233***	0.120***	0.047	-0.224***	0.119***	0.196**
	[0.030]	[0.046]	[0.059]	[0.027]	[0.043]	[0.096]
	(0.000)	(0.008)	(0.431)	(0.000)	(0.006)	(0.042)
Observations	1,615	1,615	1,615	1,819	1,819	1,819

standard errors in brackets, p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Figure 3: Model 1. Cumulative Distribution of Observed and predicted index of cognitive development

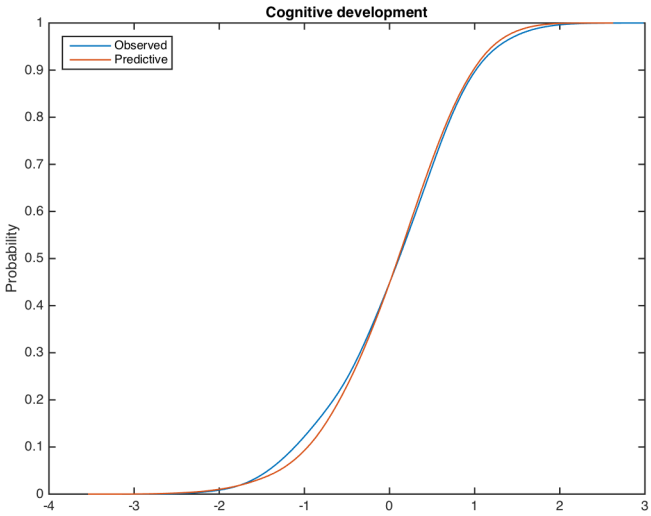


Table 7: Model 1: Structural parameters

Preference parameters

Variable	coefficient	s.e.	CV
α_C (Consumption)	0.224	0.0038	4.41
α_m (Mother's leisure)	0.232	0.0011	4.51
α_f (Father's leisure)	0.219	0.0034	7.33
α_θ (Cognitive development)	0.174	0.0010	3.67
α_σ (Risk attitudes)	0.126	0.0012	2.00
α_V (Domestic violence)	0.026	0.0001	

Correlation between preferences parameters

	α_C	α_m	α_f	α_θ
α_m	0.267			
α_f	-0.222	0.657		
α_θ	0.193	0.675	0.731	
α_σ	0.716	0.329	0.122	0.385

Cognitive production function

Variable	coefficient	s.e.
a_{τ_m} (Mother's investment (time))	0.114	0.0010
a_I (Parental investment (money))	0.194	0.0052
a_{θ_0} (Cognitive development (lagged))	1.337	0.0321
a_V (Domestic Violence)	-0.020	0.0006
a_{θ_m} (Mother's capital)	0.296	0.0051
a_{hh} (Household size)	-0.043	0.0026
a_ω (Wealth)	-0.030	0.0006

Risk attitudes function

Variable	coefficient	s.e.
b_{τ_m} (Mother's investment (time))	0.005	0.0003
b_I (Parental investment (money))	0.000	0.0000
b_{θ_0} (Cognitive development (lagged))	0.023	0.0019
b_V (Domestic Violence)	-0.174	0.0010
b_{θ_m} (Mother's capital)	0.002	0.0001
b_{hh} (Household size)	-0.153	0.0252
b_ω (Wealth)	0.039	0.0014

Standard errors are calculated as the standard deviation of parameter estimates of 200 bootstrap iterations.

A Additional Results

Table A.1: Relationship between WECs in the district and four windows of pre-program domestic violence

VARIABLES	(1) 2004-2005	(2) 2004-2008	(3) 2004-2009	(4) 2004-2013
WEC in the district in 2007	0.055			
	[0.081]			
	(0.498)			
WEC in the district in 2008	-0.045			
	[0.092]			
	(0.624)			
WEC in the district in 2010	-0.046	-0.012		
	[0.092]	[0.026]		
	(0.618)	(0.636)		
WEC in the district in 2011	0.080	0.038	0.029	
	[0.089]	[0.026]	[0.018]	
	(0.370)	(0.137)	(0.108)	
WEC in the district in 2012	0.083	0.021	0.019	
	[0.084]	[0.034]	[0.023]	
	(0.325)	(0.535)	(0.406)	
WEC in the district in 2013	0.139	0.054	0.034	
	[0.097]	[0.040]	[0.031]	
	(0.157)	(0.181)	(0.267)	
WEC in the district in 2014	-0.002	0.080*	0.043	0.014
	[0.096]	[0.047]	[0.027]	[0.012]
	(0.984)	(0.090)	(0.116)	(0.246)
Year Fixed effects	Yes	Yes	Yes	Yes
Observations	101	268	383	839
R-squared	0.096	0.036	0.044	0.033
F p-value	0.100	0.199	0.221	0.246

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

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

Notes: Clustering at the district level. The dependent variable is the change in domestic violence at the district level. Domestic violence is defined as experiencing physical or sexual violence. The observations correspond to the pre-program period of the WEC center rollout for each district. All districts that ever had a WEC center that opened between 2006-2014, 2009-2014, 2010-2014 and 2013-2014 are included. The data correspond to the Peruvian DHS.

Table A.2: IV regressions of the effect of Domestic Violence on Various Outcomes

	Cog. Devlop.	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: Cog. Dev.	4th wave - 12 year old: BMI at 12 years	4th wave - 12 year old: Daily hours playing	4th wave - 12 year old: Daily hours studying
DV index	-0.354*	-0.888**	-0.577	-0.788**	-0.801**	-0.833**	-0.660*	0.023	0.089	1.047**	-1.129**	0.110	-1.687***	0.534	-0.411	0.493	-1.631***	1.165**
	[0.213]	[0.399]	[0.355]	[0.387]	[0.389]	[0.392]	[0.363]	[0.199]	[0.111]	[0.441]	[0.459]	[0.320]	[0.580]	[0.364]	[0.264]	[0.360]	[0.578]	[0.474]
	(0.096)	(0.026)	(0.104)	(0.042)	(0.039)	(0.034)	(0.069)	(0.908)	(0.424)	(0.018)	(0.014)	(0.730)	(0.004)	(0.142)	(0.119)	(0.171)	(0.005)	(0.014)
Cog ability (lagged)	0.434***	-0.016	0.057	-0.004	-0.013	-0.035	-0.039	0.068**	0.057***	0.164**	-0.089	-0.000	-0.073	0.068	0.400***	0.107**	-0.162*	0.113
	[0.039]	[0.060]	[0.053]	[0.058]	[0.058]	[0.059]	[0.054]	[0.028]	[0.017]	[0.066]	[0.068]	[0.048]	[0.085]	[0.054]	[0.035]	[0.052]	[0.085]	[0.069]
	(0.000)	(0.790)	(0.282)	(0.942)	(0.829)	(0.546)	(0.477)	(0.015)	(0.001)	(0.013)	(0.189)	(0.992)	(0.393)	(0.204)	(0.000)	(0.041)	(0.055)	(0.103)
Mother's capital	0.258***	0.102**	0.057	0.100**	0.075*	0.105***	0.080**	0.097***	0.016	0.010	0.094**	0.029	0.224***	0.094**	0.276***	0.052	0.289***	-0.075
	[0.028]	[0.041]	[0.036]	[0.039]	[0.040]	[0.040]	[0.037]	[0.019]	[0.012]	[0.045]	[0.047]	[0.033]	[0.059]	[0.037]	[0.027]	[0.038]	[0.062]	[0.051]
	(0.000)	(0.012)	(0.115)	(0.011)	(0.058)	(0.009)	(0.031)	(0.000)	(0.173)	(0.819)	(0.045)	(0.381)	(0.000)	(0.011)	(0.000)	(0.175)	(0.000)	(0.143)
Wealth index (w. 1)	0.186***	-0.100***	-0.034	-0.083***	-0.077**	-0.092***	-0.110***	0.059***	0.039***	0.229***	-0.180***	0.026	-0.091*	0.146***	0.153***	0.210***	-0.016	0.148***
	[0.019]	[0.032]	[0.029]	[0.031]	[0.031]	[0.032]	[0.029]	[0.015]	[0.009]	[0.036]	[0.037]	[0.026]	[0.047]	[0.029]	[0.020]	[0.029]	[0.047]	[0.039]
	(0.000)	(0.002)	(0.239)	(0.008)	(0.014)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.312)	(0.052)	(0.000)	(0.000)	(0.000)	(0.728)	(0.000)
Family size	-0.031*	0.007	-0.012	0.031	0.004	-0.002	0.003	-0.036**	-0.020**	-0.027	0.050	-0.035	0.108**	-0.068**	-0.002	-0.015	0.051	-0.046
	[0.018]	[0.031]	[0.027]	[0.030]	[0.030]	[0.030]	[0.028]	[0.015]	[0.009]	[0.034]	[0.035]	[0.025]	[0.044]	[0.028]	[0.018]	[0.026]	[0.043]	[0.035]
	(0.099)	(0.828)	(0.671)	(0.299)	(0.888)	(0.957)	(0.909)	(0.015)	(0.024)	(0.424)	(0.153)	(0.149)	(0.014)	(0.014)	(0.919)	(0.569)	(0.233)	(0.196)
Two-parent HH	0.001	-0.008	-0.019	0.005	-0.008	-0.000	-0.014	-0.001	0.006	-0.028	0.015	-0.030	0.028	-0.006	0.028	-0.033	0.001	-0.013
	[0.019]	[0.030]	[0.026]	[0.029]	[0.029]	[0.029]	[0.027]	[0.014]	[0.009]	[0.033]	[0.034]	[0.024]	[0.043]	[0.027]	[0.018]	[0.026]	[0.043]	[0.035]
	(0.970)	(0.790)	(0.479)	(0.869)	(0.792)	(0.995)	(0.598)	(0.922)	(0.467)	(0.393)	(0.661)	(0.206)	(0.509)	(0.834)	(0.121)	(0.212)	(0.975)	(0.719)
bservations	1,615	1,822	1,822	1,822	1,822	1,822	1,822	1,792	1,794	1,828	1,828	1,817	1,831	1,830	1,746	1,765	1,760	1,760
R-squared	0.154	-0.515	-0.200	-0.418	-0.446	-0.463	-0.256	0.037	-0.028	-0.847	-1.024	-0.007	-2.369	-0.273	0.070	-0.151	-2.084	-1.056
Anderson-Rubin test	14.63	12.13	12.13	12.13	12.13	12.13	12.13	10.81	13.39	12.28	12.29	12.16	12.15	12.15	10.19	11.40	11.97	11.97
A-R F-test	8.792	3.975	1.590	2.967	3.081	3.545	3.566	1.357	0.356	11.26	14.16	3.581	34.06	2.491	5.633	8.019	20.51	6.412
p-value	0.000159	0.0189	0.204	0.0517	0.0461	0.0291	0.0285	0.258	0.701	1.38e-05	7.91e-07	0.0280	0	0.0831	0.00364	0.000341	1.57e-09	0.00168

standard errors in brackets, p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A.3: IV regressions of the effect of Parental Investment and Domestic Violence on Various Outcomes

															4th wave - 12 year old			
	Cog. Devlop.	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	Cog. Dev.	BMI at 12 years	Daily hours playing	Daily hours studying
Parental investment	0.349**	0.218	0.004	0.269	0.277	0.077	0.230	0.123	-0.033	-0.345	0.294	-0.108	0.514	0.489*	0.552***	-0.386	-0.684*	0.888*
	[0.172]	[0.283]	[0.265]	[0.278]	[0.277]	[0.280]	[0.262]	[0.140]	[0.087]	[0.313]	[0.345]	[0.246]	[0.419]	[0.276]	[0.207]	[0.296]	[0.375]	[0.476]
	(0.043)	(0.442)	(0.988)	(0.332)	(0.317)	(0.782)	(0.381)	(0.377)	(0.703)	(0.271)	(0.395)	(0.660)	(0.220)	(0.077)	(0.008)	(0.192)	(0.068)	(0.062)
DV index	-0.339*	-0.733**	-0.558*	-0.640*	-0.629*	-0.709**	-0.518	0.036	0.063	0.846**	-1.092***	0.156	-1.548***	0.527	-0.333	0.367	0.865**	-1.433***
	[0.196]	[0.345]	[0.323]	[0.338]	[0.337]	[0.341]	[0.319]	[0.180]	[0.102]	[0.377]	[0.418]	[0.298]	[0.510]	[0.336]	[0.232]	[0.313]	[0.396]	[0.503]
	(0.084)	(0.033)	(0.084)	(0.058)	(0.062)	(0.038)	(0.104)	(0.840)	(0.537)	(0.025)	(0.009)	(0.602)	(0.002)	(0.117)	(0.152)	(0.242)	(0.029)	(0.004)
Cog. dev. (w. 2)	0.383***	-0.025	0.054	-0.024	-0.031	-0.023	-0.048	0.045	0.058***	0.165**	-0.116	0.024	-0.119	-0.029	0.318***	0.122*	0.166**	-0.263**
	[0.043]	[0.067]	[0.062]	[0.065]	[0.065]	[0.066]	[0.062]	[0.033]	[0.020]	[0.073]	[0.081]	[0.058]	[0.099]	[0.065]	[0.044]	[0.065]	[0.081]	[0.103]
	(0.000)	(0.709)	(0.388)	(0.714)	(0.636)	(0.722)	(0.433)	(0.167)	(0.004)	(0.024)	(0.154)	(0.685)	(0.229)	(0.658)	(0.000)	(0.060)	(0.040)	(0.010)
Mother's capital	0.230***	0.102**	0.050	0.092**	0.070*	0.117***	0.082**	0.085***	0.016	-0.008	0.096*	0.039	0.224***	0.042	0.241***	0.038	-0.070	0.259***
	[0.030]	[0.041]	[0.038]	[0.040]	[0.040]	[0.041]	[0.038]	[0.021]	[0.013]	[0.045]	[0.050]	[0.035]	[0.061]	[0.040]	[0.028]	[0.040]	[0.051]	[0.064]
	(0.000)	(0.013)	(0.193)	(0.022)	(0.081)	(0.004)	(0.031)	(0.000)	(0.203)	(0.867)	(0.054)	(0.277)	(0.000)	(0.295)	(0.000)	(0.339)	(0.166)	(0.000)
Wealth index (w. 1)	0.155***	0.034	-0.044	-0.012	0.046	0.077	0.038	0.040	0.010	-0.049	-0.052	0.065	0.157*	-0.045	0.120***	-0.013	-0.085	0.121
	[0.039]	[0.059]	[0.055]	[0.058]	[0.058]	[0.058]	[0.055]	[0.029]	[0.018]	[0.065]	[0.072]	[0.051]	[0.087]	[0.057]	[0.039]	[0.056]	[0.071]	[0.090]
	(0.000)	(0.567)	(0.426)	(0.830)	(0.428)	(0.189)	(0.490)	(0.177)	(0.590)	(0.449)	(0.463)	(0.204)	(0.072)	(0.435)	(0.002)	(0.818)	(0.228)	(0.176)
Family size	-0.028	-0.002	-0.018	0.025	-0.002	-0.011	-0.005	-0.040***	-0.018**	-0.021	0.050	-0.036	0.096**	-0.065**	-0.004	-0.021	-0.050	0.050
	[0.019]	[0.029]	[0.027]	[0.028]	[0.028]	[0.029]	[0.027]	[0.015]	[0.009]	[0.032]	[0.035]	[0.025]	[0.042]	[0.028]	[0.018]	[0.026]	[0.033]	[0.042]
	(0.129)	(0.938)	(0.494)	(0.371)	(0.932)	(0.704)	(0.851)	(0.006)	(0.047)	(0.497)	(0.152)	(0.142)	(0.023)	(0.020)	(0.815)	(0.429)	(0.130)	(0.238)
Two-parent HH	-0.013	-0.011	-0.024	-0.003	-0.013	0.004	-0.015	-0.008	0.009	-0.026	0.009	-0.025	0.017	-0.027	0.006	-0.027	0.004	-0.024
	[0.019]	[0.029]	[0.027]	[0.029]	[0.028]	[0.029]	[0.027]	[0.015]	[0.009]	[0.032]	[0.035]	[0.025]	[0.043]	[0.028]	[0.019]	[0.027]	[0.034]	[0.044]
	(0.505)	(0.713)	(0.381)	(0.918)	(0.654)	(0.897)	(0.589)	(0.581)	(0.348)	(0.413)	(0.795)	(0.318)	(0.695)	(0.334)	(0.730)	(0.307)	(0.912)	(0.589)
Income (w. 2)	-0.012	-0.070	0.036	-0.064	-0.098	-0.055	-0.074	0.028	0.004	0.170*	-0.092	-0.017	-0.084	0.025	-0.044	0.274***	0.306**	-0.209
	[0.053]	[0.087]	[0.081]	[0.085]	[0.085]	[0.086]	[0.080]	[0.043]	[0.027]	[0.096]	[0.105]	[0.075]	[0.128]	[0.085]	[0.065]	[0.093]	[0.119]	[0.151]
	(0.817)	(0.421)	(0.659)	(0.450)	(0.246)	(0.522)	(0.355)	(0.516)	(0.872)	(0.075)	(0.385)	(0.821)	(0.513)	(0.771)	(0.498)	(0.003)	(0.010)	(0.165)
Income sq. (w. 2)	0.008	0.072	-0.025	0.059	0.089	0.060	0.082	-0.009	0.003	-0.132	0.034	0.000	0.047	-0.022	0.043	-0.199***	-0.221**	0.144
	[0.046]	[0.075]	[0.070]	[0.074]	[0.073]	[0.074]	[0.069]	[0.037]	[0.023]	[0.083]	[0.091]	[0.065]	[0.111]	[0.073]	[0.053]	[0.076]	[0.097]	[0.123]
	(0.861)	(0.340)	(0.722)	(0.425)	(0.225)	(0.417)	(0.238)	(0.805)	(0.885)	(0.110)	(0.707)	(0.998)	(0.672)	(0.766)	(0.419)	(0.009)	(0.022)	(0.239)
No income reported (w. 2)	-0.036	0.103*	0.038	0.063	0.074	0.102*	0.128**	-0.011	-0.000	-0.050	-0.081	0.022	-0.046	-0.038	-0.031	0.000	0.092	0.019
	[0.035]	[0.057]	[0.053]	[0.056]	[0.055]	[0.056]	[0.053]	[0.028]	[0.017]	[0.062]	[0.069]	[0.049]	[0.084]	[0.055]	[0.039]	[0.056]	[0.071]	[0.090]
	(0.302)	(0.069)	(0.474)	(0.260)	(0.183)	(0.069)	(0.015)	(0.685)	(1.000)	(0.428)	(0.239)	(0.660)	(0.587)	(0.493)	(0.424)	(0.998)	(0.193)	(0.835)
Proxy means test for CCT	0.047	0.196**	-0.004	0.134	0.190**	0.207**	0.215**	0.013	-0.041	-0.376***	0.201*	0.015	0.395***	-0.107	0.081	-0.302***	-0.372***	0.330**
	[0.059]	[0.096]	[0.090]	[0.094]	[0.094]	[0.095]	[0.089]	[0.048]	[0.029]	[0.106]	[0.117]	[0.083]	[0.142]	[0.093]	[0.069]	[0.099]	[0.123]	[0.156]
	(0.431)	(0.042)	(0.966)	(0.154)	(0.043)	(0.030)	(0.015)	(0.791)	(0.148)	(0.000)	(0.086)	(0.857)	(0.005)	(0.254)	(0.240)	(0.002)	(0.003)	(0.035)
Observations	1,615	1,819	1,819	1,819	1,819	1,819	1,819	1,789	1,791	1,826	1,825	1,814	1,828	1,827	1,743	1,762	1,757	1,757
Anderson-Rubin test	16.87	14.37	14.37	14.37	14.37	14.37	14.37	13.06	15.53	14.61	14.47	14.25	14.36	14.36	12.78	14.30	14.69	14.69
A-R F-test	6.523	2.301	1.185	1.904	1.864	2.059	2.081	0.980	0.182	6.921	9.869	2.386	22.37	3.037	5.016	5.335	4.388	13.93
p-value	0.000220	0.0754	0.314	0.127	0.134	0.104	0.101	0.401	0.909	0.000124	1.87e-06	0.0674	0	0.0281	0.00183	0.00117	0.00439	5.59e-09

standard errors in brackets, p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A.4: IV regressions of the effect of Parental Investment and Domestic Violence on Various Outcomes - excluding WECs instrument

															4th wave - 12 year old			
	Cog. Devlop.	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	Cog. Dev.	BMI at 12 years	Daily hours playing	Daily hours studying
Parental investment	0.473	0.243	0.005	0.248	0.261	0.112	0.316	0.172	-0.035	-0.524	0.505	-0.251	0.819	0.545**	0.702**	-0.693	1.149	-0.674*
	[0.316]	[0.310]	[0.272]	[0.272]	[0.274]	[0.314]	[0.332]	[0.153]	[0.089]	[0.502]	[0.594]	[0.342]	[0.809]	[0.258]	[0.308]	[0.502]	[0.740]	[0.385]
	(0.135)	(0.433)	(0.986)	(0.363)	(0.340)	(0.722)	(0.342)	(0.259)	(0.694)	(0.297)	(0.395)	(0.463)	(0.311)	(0.035)	(0.023)	(0.168)	(0.120)	(0.080)
DV index	-1.259**	-0.890	-0.563	-0.505	-0.532	-0.923	-1.051*	-0.249	0.077	1.885**	-2.371**	1.020*	-3.416**	0.185	-0.868*	1.499**	-2.511**	0.825
	[0.629]	[0.560]	[0.492]	[0.492]	[0.496]	[0.568]	[0.601]	[0.284]	[0.157]	[0.883]	[1.065]	[0.612]	[1.457]	[0.467]	[0.494]	[0.755]	[1.158]	[0.603]
	(0.045)	(0.112)	(0.253)	(0.304)	(0.283)	(0.104)	(0.081)	(0.382)	(0.626)	(0.033)	(0.026)	(0.096)	(0.019)	(0.691)	(0.079)	(0.047)	(0.030)	(0.171)
Lagged index of cog ability	0.317***	-0.034	0.054	-0.016	-0.025	-0.036	-0.079	0.031	0.059***	0.222*	-0.187	0.075	-0.223	-0.048	0.290***	0.197*	-0.321**	0.164**
	[0.085]	[0.075]	[0.066]	[0.066]	[0.066]	[0.076]	[0.081]	[0.036]	[0.021]	[0.120]	[0.143]	[0.083]	[0.196]	[0.062]	[0.065]	[0.111]	[0.160]	[0.083]
	(0.000)	(0.652)	(0.417)	(0.806)	(0.704)	(0.639)	(0.327)	(0.386)	(0.005)	(0.063)	(0.190)	(0.367)	(0.253)	(0.443)	(0.000)	(0.077)	(0.045)	(0.049)
Mother's capital	0.240***	0.105**	0.050	0.089**	0.067*	0.122***	0.095**	0.089***	0.016	-0.032	0.127	0.019	0.269**	0.050	0.265***	-0.010	0.304***	-0.068
	[0.055]	[0.045]	[0.039]	[0.039]	[0.040]	[0.046]	[0.048]	[0.022]	[0.013]	[0.072]	[0.086]	[0.049]	[0.117]	[0.037]	[0.043]	[0.069]	[0.102]	[0.053]
	(0.000)	(0.019)	(0.205)	(0.024)	(0.089)	(0.007)	(0.050)	(0.000)	(0.228)	(0.653)	(0.139)	(0.702)	(0.021)	(0.179)	(0.000)	(0.888)	(0.003)	(0.200)
Wealth index (w. 1)	0.221***	0.044	-0.044	-0.021	0.039	0.091	0.072	0.057*	0.009	-0.116	0.030	0.009	0.276	-0.023	0.159***	-0.097	0.200	-0.082
	[0.079]	[0.069]	[0.060]	[0.060]	[0.061]	[0.070]	[0.074]	[0.034]	[0.020]	[0.110]	[0.131]	[0.075]	[0.178]	[0.057]	[0.061]	[0.100]	[0.148]	[0.077]
	(0.005)	(0.523)	(0.469)	(0.726)	(0.516)	(0.193)	(0.326)	(0.093)	(0.651)	(0.290)	(0.820)	(0.900)	(0.121)	(0.687)	(0.009)	(0.327)	(0.177)	(0.287)
Family size	-0.015	0.001	-0.018	0.023	-0.004	-0.006	0.006	-0.033**	-0.018*	-0.043	0.076	-0.054	0.134	-0.058**	0.004	-0.036	0.066	-0.050
	[0.034]	[0.032]	[0.028]	[0.028]	[0.028]	[0.032]	[0.034]	[0.017]	[0.009]	[0.051]	[0.061]	[0.035]	[0.083]	[0.026]	[0.026]	[0.043]	[0.064]	[0.033]
	(0.665)	(0.974)	(0.514)	(0.423)	(0.876)	(0.844)	(0.858)	(0.044)	(0.055)	(0.403)	(0.211)	(0.126)	(0.106)	(0.027)	(0.869)	(0.404)	(0.307)	(0.136)
Two-parent HH	-0.002	-0.011	-0.024	-0.003	-0.013	0.004	-0.014	-0.007	0.008	-0.029	0.013	-0.028	0.023	-0.026	0.009	-0.030	-0.014	0.004
	[0.035]	[0.031]	[0.027]	[0.027]	[0.027]	[0.031]	[0.033]	[0.016]	[0.009]	[0.050]	[0.059]	[0.034]	[0.081]	[0.026]	[0.026]	[0.044]	[0.066]	[0.034]
	(0.962)	(0.735)	(0.382)	(0.909)	(0.639)	(0.898)	(0.678)	(0.654)	(0.362)	(0.564)	(0.826)	(0.419)	(0.780)	(0.303)	(0.719)	(0.489)	(0.830)	(0.902)
Income (w. 2)	-0.039	-0.074	0.036	-0.061	-0.096	-0.060	-0.088	0.020	0.005	0.198	-0.126	0.006	-0.133	0.016	-0.076	0.332**	-0.267	0.303**
	[0.097]	[0.093]	[0.082]	[0.082]	[0.082]	[0.094]	[0.100]	[0.046]	[0.027]	[0.150]	[0.178]	[0.102]	[0.243]	[0.077]	[0.094]	[0.153]	[0.229]	[0.119]
	(0.689)	(0.428)	(0.663)	(0.458)	(0.245)	(0.522)	(0.379)	(0.662)	(0.863)	(0.188)	(0.478)	(0.956)	(0.583)	(0.840)	(0.420)	(0.030)	(0.245)	(0.011)
Income sq. (w. 2)	0.021	0.073	-0.025	0.057	0.088	0.062	0.088	-0.006	0.003	-0.144	0.049	-0.009	0.068	-0.018	0.061	-0.230*	0.175	-0.220**
	[0.083]	[0.080]	[0.070]	[0.070]	[0.071]	[0.081]	[0.086]	[0.040]	[0.023]	[0.129]	[0.153]	[0.088]	[0.209]	[0.067]	[0.075]	[0.124]	[0.184]	[0.096]
	(0.805)	(0.361)	(0.724)	(0.416)	(0.215)	(0.442)	(0.309)	(0.882)	(0.891)	(0.265)	(0.748)	(0.916)	(0.746)	(0.787)	(0.420)	(0.063)	(0.342)	(0.022)
No income reported (w. 2)	-0.049	0.101*	0.038	0.065	0.075	0.099	0.120*	-0.015	0.000	-0.036	-0.099	0.034	-0.071	-0.043	-0.041	0.023	-0.004	0.091
	[0.063]	[0.061]	[0.054]	[0.053]	[0.054]	[0.062]	[0.065]	[0.030]	[0.018]	[0.098]	[0.116]	[0.067]	[0.159]	[0.051]	[0.055]	[0.091]	[0.135]	[0.070]
	(0.441)	(0.097)	(0.477)	(0.226)	(0.163)	(0.108)	(0.066)	(0.609)	(0.992)	(0.717)	(0.395)	(0.615)	(0.653)	(0.398)	(0.447)	(0.797)	(0.978)	(0.194)
Proxy means test for CCT	0.174	0.218*	-0.003	0.115	0.176*	0.237**	0.292**	0.053	-0.043	-0.530***	0.386*	-0.109	0.664**	-0.057	0.177	-0.510***	0.516*	-0.365**
	[0.128]	[0.119]	[0.105]	[0.105]	[0.105]	[0.121]	[0.128]	[0.059]	[0.033]	[0.192]	[0.228]	[0.131]	[0.310]	[0.099]	[0.117]	[0.190]	[0.278]	[0.145]
	(0.175)	(0.067)	(0.976)	(0.272)	(0.095)	(0.049)	(0.023)	(0.369)	(0.188)	(0.006)	(0.090)	(0.404)	(0.032)	(0.562)	(0.132)	(0.007)	(0.064)	(0.012)
Observations	1,615	1,819	1,819	1,819	1,819	1,819	1,819	1,789	1,791	1,826	1,825	1,814	1,828	1,827	1,743	1,762	1,757	1,757
R-squared	-1.642	-0.533	-0.189	-0.174	-0.202	-0.573	-0.763	-0.090	-0.017	-2.914	-4.559	-0.895	-9.944	-0.064	-0.807	-1.909	-5.430	-0.726
Anderson-Rubin test	5.221	6.158	6.158	6.158	6.158	6.158	6.158	5.873	6.602	6.448	6.215	6.184	6.200	6.141	5.467	6.394	6.078	6.078
A-R F-test	9.787	2.115	0.806	0.920	1.031	2.099	3.053	0.954	0.178	10.37	14.73	2.776	33.45	2.897	7.528	7.115	18.88	3.390
p-value	5.96e-05	0.121	0.447	0.399	0.357	0.123	0.0475	0.385	0.837	3.32e-05	4.51e-07	0.0626	0	0.0554	0.000555	0.000837	7.73e-09	0.0339

standard errors in brackets, p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A.5: IV regressions of the effect of Parental Investment and Domestic Violence on Various Outcomes - excluding never CTC qualifiers

															4th wave - 12 year old			
	Cog. Devlop.	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	Cog. Dev.	BMI at 12 years	Daily hours playing	Daily hours studying
Parental investment	1.048	-0.936	0.243	0.101	-0.666	-1.206	-1.744	-0.359	-0.056	-0.853	5.715**	-2.233	3.155	-0.439	0.233	-1.465	0.167	0.114
	[0.810]	[1.462]	[1.343]	[1.509]	[1.385]	[1.418]	[1.456]	[0.787]	[0.413]	[1.150]	[2.862]	[1.547]	[2.235]	[1.172]	[0.985]	[1.099]	[1.678]	[1.069]
	(0.196)	(0.522)	(0.857)	(0.947)	(0.630)	(0.395)	(0.231)	(0.648)	(0.892)	(0.458)	(0.046)	(0.149)	(0.158)	(0.708)	(0.813)	(0.183)	(0.921)	(0.915)
DV index	-0.400*	-0.783*	-0.631*	-0.944**	-0.681*	-0.617	-0.454	0.281	0.005	0.393	-0.676	-0.370	-1.146*	0.171	-0.485*	0.152	-1.318**	0.394
	[0.214]	[0.415]	[0.381]	[0.429]	[0.393]	[0.403]	[0.414]	[0.244]	[0.117]	[0.326]	[0.810]	[0.461]	[0.633]	[0.331]	[0.294]	[0.346]	[0.519]	[0.331]
	(0.061)	(0.060)	(0.098)	(0.028)	(0.083)	(0.126)	(0.272)	(0.249)	(0.966)	(0.227)	(0.404)	(0.422)	(0.070)	(0.605)	(0.099)	(0.660)	(0.011)	(0.234)
Lagged index of cog ability	0.368***	0.104	0.100	0.007	0.084	0.098	0.136	0.065	0.041	0.129	-0.503**	0.130	-0.273	0.066	0.337***	0.107	-0.128	0.040
	[0.070]	[0.128]	[0.117]	[0.132]	[0.121]	[0.124]	[0.127]	[0.066]	[0.034]	[0.100]	[0.250]	[0.135]	[0.195]	[0.102]	[0.081]	[0.101]	[0.148]	[0.094]
	(0.000)	(0.414)	(0.393)	(0.957)	(0.486)	(0.428)	(0.286)	(0.323)	(0.229)	(0.200)	(0.044)	(0.335)	(0.162)	(0.518)	(0.000)	(0.291)	(0.386)	(0.667)
Mother's capital	0.160***	0.162**	0.058	0.126*	0.123**	0.178***	0.157**	0.088**	0.018	0.005	-0.106	0.127*	0.123	0.060	0.250***	0.055	0.301***	-0.087*
	[0.058]	[0.066]	[0.060]	[0.068]	[0.062]	[0.064]	[0.066]	[0.036]	[0.019]	[0.052]	[0.128]	[0.072]	[0.100]	[0.053]	[0.040]	[0.050]	[0.077]	[0.049]
	(0.005)	(0.014)	(0.340)	(0.064)	(0.049)	(0.005)	(0.017)	(0.014)	(0.354)	(0.919)	(0.409)	(0.077)	(0.220)	(0.258)	(0.000)	(0.270)	(0.000)	(0.075)
Wealth index (w. 1)	0.197***	0.051	-0.017	0.026	0.057	0.071	0.047	0.015	0.004	-0.072	-0.022	0.097	0.223*	-0.047	0.145***	-0.006	0.101	-0.053
	[0.053]	[0.078]	[0.072]	[0.081]	[0.074]	[0.076]	[0.078]	[0.043]	[0.022]	[0.061]	[0.152]	[0.087]	[0.119]	[0.062]	[0.052]	[0.066]	[0.100]	[0.064]
	(0.000)	(0.519)	(0.817)	(0.752)	(0.443)	(0.349)	(0.546)	(0.737)	(0.852)	(0.239)	(0.885)	(0.265)	(0.061)	(0.454)	(0.006)	(0.932)	(0.312)	(0.404)
Family size	-0.078**	0.052	0.013	0.056	0.034	0.049	0.052	-0.031	-0.005	0.020	-0.100	-0.011	-0.010	-0.061	-0.035	0.013	0.009	-0.005
	[0.032]	[0.052]	[0.048]	[0.053]	[0.049]	[0.050]	[0.052]	[0.028]	[0.015]	[0.040]	[0.099]	[0.055]	[0.078]	[0.041]	[0.037]	[0.043]	[0.065]	[0.041]
	(0.013)	(0.319)	(0.783)	(0.292)	(0.489)	(0.330)	(0.312)	(0.254)	(0.752)	(0.608)	(0.315)	(0.847)	(0.897)	(0.134)	(0.342)	(0.766)	(0.886)	(0.899)
Two-parent HH	-0.061*	0.028	-0.043	0.019	0.030	0.047	0.035	0.008	0.012	0.018	-0.135	0.049	-0.061	0.005	0.005	0.026	-0.006	0.029
	[0.037]	[0.057]	[0.052]	[0.059]	[0.054]	[0.055]	[0.057]	[0.031]	[0.016]	[0.045]	[0.111]	[0.063]	[0.087]	[0.045]	[0.037]	[0.045]	[0.067]	[0.043]
	(0.093)	(0.623)	(0.414)	(0.748)	(0.577)	(0.394)	(0.539)	(0.787)	(0.468)	(0.683)	(0.225)	(0.442)	(0.487)	(0.920)	(0.890)	(0.566)	(0.924)	(0.495)
Income (w. 2)	0.077	0.156	-0.141	-0.064	0.115	0.194	0.387	0.202	0.018	0.432	-1.450**	0.575	-0.600	0.623**	0.222	0.823***	-0.028	0.170
	[0.230]	[0.374]	[0.343]	[0.386]	[0.354]	[0.363]	[0.372]	[0.205]	[0.110]	[0.295]	[0.733]	[0.389]	[0.573]	[0.300]	[0.261]	[0.281]	[0.441]	[0.281]
	(0.739)	(0.677)	(0.681)	(0.868)	(0.746)	(0.592)	(0.299)	(0.323)	(0.873)	(0.143)	(0.048)	(0.139)	(0.295)	(0.038)	(0.395)	(0.003)	(0.949)	(0.545)
Income sq. (w. 2)	-1.579*	0.367	1.173	0.768	0.415	0.039	-0.371	-0.384	0.099	-0.749	-0.752	0.730	-0.626	-1.765*	-0.443	-1.222	-0.907	-0.665
	[0.911]	[1.294]	[1.188]	[1.335]	[1.226]	[1.255]	[1.288]	[0.716]	[0.382]	[1.009]	[2.513]	[1.444]	[1.961]	[1.026]	[0.859]	[1.125]	[1.726]	[1.099]
	(0.083)	(0.777)	(0.324)	(0.565)	(0.735)	(0.975)	(0.773)	(0.592)	(0.795)	(0.458)	(0.765)	(0.613)	(0.749)	(0.085)	(0.606)	(0.277)	(0.599)	(0.545)
No income reported (w. 2)	-0.018	0.020	0.019	0.014	0.013	0.012	0.024	0.004	-0.023	-0.072	0.086	-0.071	0.057	-0.137	-0.045	-0.023	-0.020	-0.001
	[0.084]	[0.127]	[0.117]	[0.131]	[0.120]	[0.123]	[0.127]	[0.070]	[0.037]	[0.099]	[0.247]	[0.140]	[0.193]	[0.101]	[0.082]	[0.106]	[0.161]	[0.103]
	(0.827)	(0.877)	(0.869)	(0.913)	(0.916)	(0.922)	(0.848)	(0.952)	(0.525)	(0.470)	(0.729)	(0.612)	(0.769)	(0.174)	(0.585)	(0.827)	(0.902)	(0.991)
Proxy means test for CCT	0.172	-0.059	0.102	0.132	-0.010	-0.113	-0.250	-0.152	-0.056	-0.458*	1.196*	-0.334	1.002*	-0.307	0.068	-0.513**	0.181	-0.218
	[0.171]	[0.337]	[0.309]	[0.348]	[0.319]	[0.327]	[0.336]	[0.186]	[0.093]	[0.264]	[0.656]	[0.362]	[0.512]	[0.268]	[0.229]	[0.260]	[0.388]	[0.247]
	(0.314)	(0.861)	(0.741)	(0.705)	(0.975)	(0.729)	(0.457)	(0.412)	(0.545)	(0.082)	(0.069)	(0.356)	(0.050)	(0.252)	(0.766)	(0.049)	(0.641)	(0.377)
Observations	937	1,099	1,099	1,099	1,099	1,099	1,099	1,074	1,077	1,104	1,103	1,094	1,104	1,103	1,048	1,062	1,059	1,059
R-squared	0.085	-0.490	-0.255	-0.649	-0.378	-0.411	-0.456	-0.238	0.013	-0.376	-4.424	-0.850	-2.375	-0.066	-0.031	-0.430	-1.407	-0.137
Anderson-Rubin test	7.375	4.618	4.618	4.618	4.618	4.618	4.618	4.617	4.972	4.587	4.570	4.938	4.587	4.571	4.059	5.621	5.729	5.729
A-R F-test	2.787	3.329	1.930	3.310	2.161	2.657	2.631	0.841	0.273	1.717	10.62	2.903	12.25	2.219	2.583	2.183	10.61	0.736
p-value	0.0397	0.0190	0.123	0.0195	0.0910	0.0472	0.0488	0.471	0.845	0.162	6.92e-07	0.0339	6.92e-08	0.0843	0.0521	0.0885	7.13e-07	0.531

standard errors in brackets, p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table A.6: Effect of measurement error on estimated coefficients

Variable	Cognitive Developmenet				Lottery decision			
	IV coeff.	S.E.	Corrected coeff.	Diff.	IV coeff.	S.E.	Corrected coeff.	Diff.
Parental Investment	0.349	0.179	0.349	0.000	0.216	0.283	0.196	0.020
DV index	-0.341	0.196	-0.335	-0.006	-0.733	0.345	-0.664	-0.069
Cog. Development (w. 2)	0.383	0.043	0.439	-0.056	-0.024	0.067	-0.021	-0.002
Mother's capital	0.231	0.030	0.231	-0.001	0.102	0.041	0.130	-0.028
Wealth index (w. 1)	0.155	0.039	0.153	0.002	0.034	0.059	0.031	0.003
Family size	-0.028	0.019	-0.027	-0.001	-0.002	0.029	-0.002	0.000
Two-parent HH	-0.013	0.019	-0.014	0.001	-0.011	0.029	-0.008	-0.002
Income (w. 2)	-0.012	0.053	-0.016	0.004	-0.070	0.087	-0.068	-0.002
Income sq. (w. 2)	0.008	0.046	0.011	-0.002	0.072	0.075	0.071	0.001
No income reported (w. 2)	-0.037	0.035	-0.036	-0.001	0.097	0.057	0.098	-0.001
Proxy means test for CCT	0.047	0.059	0.051	-0.005	0.195	0.096	0.188	0.006

Note: Measurement error correction of coefficient estimates follows the approach described in Section B

Figure A.1: Effect of domestic violence and mother's time investment. Pairs of parameters not rejected by data.

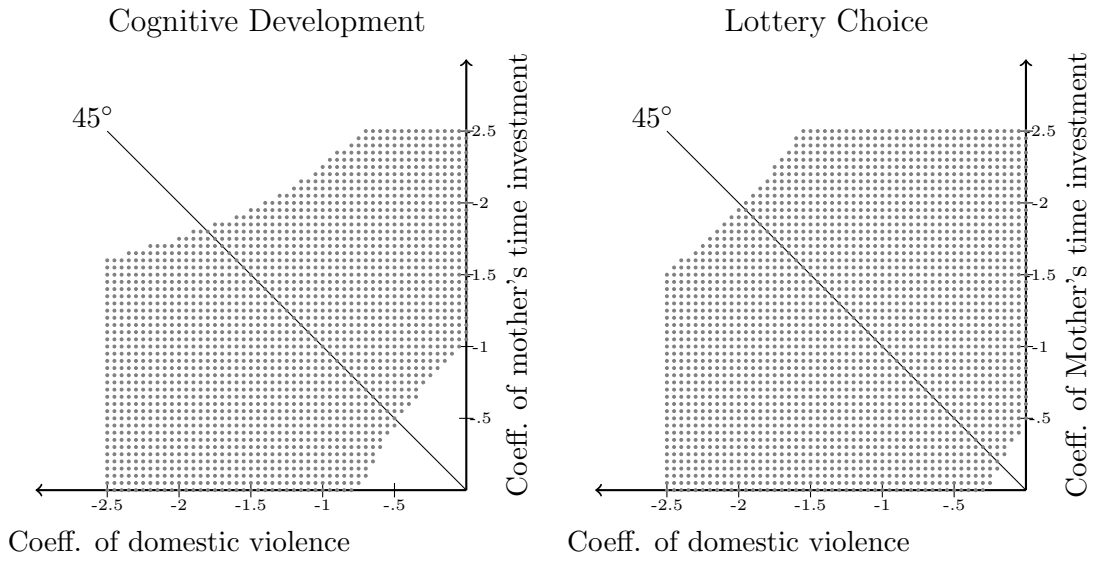


Table A.7: Confirmatory factor analysis of parental investment and domestic violence measures

	Factor 1	Factor 2	Factor 3
Monetary investments			
School related expenses	**0.7244**	-0.0272	-0.1096
Children gifts	**0.7211**	0.0068	0.0140
No. Books at home	**0.5575**	-0.0058	0.2418
Time & attention investments			
Help with homework	-0.1317	-0.0627	**0.6125**
Encourages to read	0.0696	0.0316	**0.5957**
Know child' friends' names	0.0390	0.0162	**0.6809**
Environmental variables			
Reported violence (wave 3)	-0.0427	**0.7009**	-0.0366
Reported violence (wave 2)	-0.0346	**0.6421**	0.0408
Seeked help due to IPV	-0.0233	**0.4524**	0.0208
Partner smokes	0.1879	**0.4875**	-0.0108

Table A.8: Negative Symmetry between Domestic Violence and (Time) Parental Investments

	Domestic violence index				Parental investments of time & attention			
VARIABLES	First stage	Cog. Dev.	First stage	Lot. Choice	First stage	Cog. Dev.	First stage	Lot.. Choice
Domestic violence index	.	-0.354*	.	-0.888**				
		[0.213]		[0.399]				
		(0.096)		(0.026)				
Parental investments (time & attention)					.	0.813**	.	1.445**
						[0.322]		[0.646]
						(0.012)		(0.025)
Wage gap	-0.054**		-0.055**		0.048***		0.031**	
	[0.027]		[0.026]		[0.014]		[0.013]	
	(0.042)		(0.032)		(0.000)		(0.023)	
Opening of Women Emergency Center	-0.076***		-0.060***		0.040***		0.038***	
	[0.023]		[0.022]		[0.012]		[0.012]	
	(0.001)		(0.006)		(0.001)		(0.001)	
Lagged index of cog ability	-0.066	0.434***	-0.050	-0.016	0.037	0.429***	0.050**	-0.044
	[0.045]	[0.039]	[0.041]	[0.060]	[0.023]	[0.037]	[0.022]	[0.064]
	(0.140)	(0.000)	(0.227)	(0.790)	(0.103)	(0.000)	(0.022)	(0.488)
Mother's capital	0.032	0.258***	0.047	0.102**	0.188***	0.091	0.158***	-0.165
	[0.035]	[0.028]	[0.030]	[0.041]	[0.018]	[0.071]	[0.016]	[0.119]
	(0.360)	(0.000)	(0.116)	(0.012)	(0.000)	(0.201)	(0.000)	(0.167)
Wealth index (w. 1)	-0.050**	0.186***	-0.050**	-0.100***	0.055***	0.162***	0.050***	-0.128***
	[0.024]	[0.019]	[0.023]	[0.032]	[0.012]	[0.022]	[0.012]	[0.038]
	(0.035)	(0.000)	(0.028)	(0.002)	(0.000)	(0.000)	(0.000)	(0.001)
Family size	0.018	-0.031*	0.025	0.007	-0.023**	-0.017	-0.026**	0.025
	[0.022]	[0.018]	[0.021]	[0.031]	[0.011]	[0.019]	[0.011]	[0.033]
	(0.426)	(0.099)	(0.233)	(0.828)	(0.042)	(0.363)	(0.021)	(0.452)
Two-parent HH	0.016	0.001	0.007	-0.008	0.001	-0.004	-0.001	-0.009
	[0.023]	[0.019]	[0.021]	[0.030]	[0.011]	[0.018]	[0.011]	[0.029]
	(0.489)	(0.970)	(0.754)	(0.790)	(0.955)	(0.803)	(0.916)	(0.755)
Observations	1,615	1,615	1,822	1,822	1,620	1,620	1,829	1,829
R-squared	0.012	0.154	0.009	-0.515	0.116	0.202	0.101	-0.454

pval in brackets
*** p<0.01, ** p<0.05, * p<0.10

Table A.9: IV regressions of the effect of "Parental Investment of time minus Domestic Violence" on Various Outcomes

															4th wave - 12 year old			
	Cog. Devlop.	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	Cog. Dev.	BMI at 12 years	Daily hours playing	Daily hours studying
Investments of money	-0.131	-0.448	-0.455	-0.283	-0.274	-0.552	-0.320	0.087	0.026	0.569	-0.851*	0.178	-1.138**	0.779**	0.092	0.141	-0.549	0.127
	[0.233]	[0.355]	[0.334]	[0.346]	[0.346]	[0.350]	[0.334]	[0.182]	[0.110]	[0.398]	[0.448]	[0.315]	[0.548]	[0.341]	[0.212]	[0.298]	[0.486]	[0.376]
	(0.574)	(0.207)	(0.173)	(0.414)	(0.428)	(0.115)	(0.337)	(0.632)	(0.810)	(0.152)	(0.057)	(0.572)	(0.038)	(0.022)	(0.666)	(0.637)	(0.259)	(0.735)
Investment of time minus DV	0.416**	0.669**	0.475*	0.572**	0.568**	0.632**	0.521*	0.014	-0.060	-0.856***	1.080***	-0.225	1.552***	-0.344	0.406*	-0.452	1.436***	-0.837**
	[0.184]	[0.297]	[0.279]	[0.290]	[0.289]	[0.293]	[0.279]	[0.156]	[0.089]	[0.331]	[0.374]	[0.264]	[0.459]	[0.285]	[0.210]	[0.283]	[0.454]	[0.351]
	(0.024)	(0.024)	(0.089)	(0.048)	(0.049)	(0.031)	(0.062)	(0.930)	(0.501)	(0.010)	(0.004)	(0.394)	(0.001)	(0.227)	(0.054)	(0.111)	(0.002)	(0.017)
Lagged index of cog ability	0.386***	-0.024	0.054	-0.024	-0.031	-0.022	-0.045	0.047	0.058***	0.160**	-0.111	0.019	-0.111	-0.024	0.324***	0.114*	-0.263**	0.169**
	[0.044]	[0.066]	[0.062]	[0.064]	[0.064]	[0.065]	[0.062]	[0.033]	[0.020]	[0.074]	[0.083]	[0.059]	[0.102]	[0.063]	[0.045]	[0.065]	[0.102]	[0.079]
	(0.000)	(0.720)	(0.380)	(0.705)	(0.629)	(0.738)	(0.466)	(0.154)	(0.004)	(0.030)	(0.182)	(0.747)	(0.273)	(0.703)	(0.000)	(0.077)	(0.010)	(0.033)
Mother's capital	0.227***	0.072*	0.019	0.072*	0.051	0.081**	0.064*	0.092***	0.018	0.024	0.046	0.045	0.159***	0.097***	0.252***	0.039	0.229***	-0.061
	[0.030]	[0.039]	[0.036]	[0.038]	[0.038]	[0.038]	[0.036]	[0.020]	[0.012]	[0.044]	[0.049]	[0.035]	[0.060]	[0.037]	[0.026]	[0.036]	[0.059]	[0.045]
	(0.000)	(0.062)	(0.602)	(0.058)	(0.181)	(0.034)	(0.082)	(0.000)	(0.141)	(0.575)	(0.343)	(0.193)	(0.008)	(0.009)	(0.000)	(0.287)	(0.000)	(0.184)
Wealth index (w. 1)	0.157***	0.024	-0.054	-0.019	0.039	0.065	0.033	0.043	0.010	-0.041	-0.066	0.065	0.139	-0.026	0.124***	-0.013	0.113	-0.082
	[0.040]	[0.057]	[0.054]	[0.056]	[0.056]	[0.057]	[0.054]	[0.029]	[0.018]	[0.065]	[0.073]	[0.051]	[0.089]	[0.055]	[0.040]	[0.056]	[0.090]	[0.070]
	(0.000)	(0.672)	(0.315)	(0.729)	(0.485)	(0.251)	(0.543)	(0.141)	(0.567)	(0.529)	(0.365)	(0.203)	(0.116)	(0.634)	(0.002)	(0.811)	(0.209)	(0.238)
Family size	-0.026	0.005	-0.011	0.030	0.002	-0.002	0.001	-0.041***	-0.018*	-0.032	0.065*	-0.040	0.117**	-0.077***	-0.006	-0.024	0.061	-0.053
	[0.020]	[0.030]	[0.028]	[0.029]	[0.029]	[0.029]	[0.028]	[0.015]	[0.009]	[0.033]	[0.037]	[0.026]	[0.046]	[0.028]	[0.019]	[0.027]	[0.044]	[0.034]
	(0.187)	(0.864)	(0.687)	(0.305)	(0.950)	(0.951)	(0.977)	(0.008)	(0.051)	(0.336)	(0.080)	(0.123)	(0.010)	(0.006)	(0.771)	(0.385)	(0.166)	(0.121)
Two-parent HH	-0.009	-0.008	-0.022	-0.002	-0.012	0.007	-0.012	-0.008	0.008	-0.031	0.016	-0.029	0.027	-0.029	0.008	-0.031	-0.021	0.004
	[0.020]	[0.029]	[0.027]	[0.028]	[0.028]	[0.029]	[0.027]	[0.015]	[0.009]	[0.033]	[0.037]	[0.026]	[0.045]	[0.028]	[0.019]	[0.027]	[0.044]	[0.034]
	(0.652)	(0.780)	(0.430)	(0.945)	(0.680)	(0.808)	(0.675)	(0.611)	(0.359)	(0.337)	(0.656)	(0.268)	(0.548)	(0.290)	(0.657)	(0.254)	(0.637)	(0.900)
Income (w. 2)	0.004	-0.070	0.033	-0.069	-0.102	-0.054	-0.066	0.034	0.004	0.154	-0.073	-0.033	-0.055	0.036	-0.027	0.255***	-0.218	0.314***
	[0.055]	[0.085]	[0.080]	[0.083]	[0.083]	[0.084]	[0.080]	[0.043]	[0.026]	[0.096]	[0.107]	[0.075]	[0.131]	[0.081]	[0.061]	[0.086]	[0.139]	[0.108]
	(0.945)	(0.411)	(0.679)	(0.407)	(0.217)	(0.516)	(0.409)	(0.429)	(0.873)	(0.108)	(0.497)	(0.661)	(0.672)	(0.654)	(0.654)	(0.003)	(0.118)	(0.003)
Income sq. (w. 2)	-0.006	0.070	-0.024	0.061	0.091	0.057	0.073	-0.014	0.004	-0.116	0.015	0.015	0.018	-0.029	0.030	-0.182**	0.145	-0.227**
	[0.048]	[0.074]	[0.070]	[0.072]	[0.072]	[0.073]	[0.070]	[0.037]	[0.023]	[0.083]	[0.094]	[0.066]	[0.114]	[0.071]	[0.051]	[0.072]	[0.115]	[0.089]
	(0.897)	(0.346)	(0.727)	(0.396)	(0.207)	(0.431)	(0.291)	(0.711)	(0.879)	(0.165)	(0.875)	(0.823)	(0.875)	(0.685)	(0.551)	(0.011)	(0.209)	(0.011)
No income reported (w. 2)	-0.035	0.109*	0.045	0.067	0.078	0.110**	0.132**	-0.013	-0.000	-0.057	-0.070	0.020	-0.031	-0.049	-0.032	0.006	0.009	0.093
	[0.036]	[0.056]	[0.053]	[0.055]	[0.055]	[0.055]	[0.053]	[0.028]	[0.017]	[0.063]	[0.071]	[0.050]	[0.087]	[0.054]	[0.040]	[0.057]	[0.092]	[0.071]
	(0.331)	(0.051)	(0.398)	(0.221)	(0.154)	(0.047)	(0.013)	(0.645)	(0.983)	(0.370)	(0.320)	(0.688)	(0.718)	(0.360)	(0.419)	(0.911)	(0.923)	(0.191)
Proxy means test for CCT	0.039	0.186*	-0.012	0.130	0.185**	0.195**	0.206**	0.013	-0.041	-0.360***	0.178	0.024	0.364**	-0.094	0.078	-0.293***	0.325**	-0.374***
	[0.062]	[0.096]	[0.090]	[0.094]	[0.093]	[0.095]	[0.090]	[0.048]	[0.029]	[0.108]	[0.121]	[0.086]	[0.148]	[0.092]	[0.071]	[0.100]	[0.158]	[0.122]
	(0.531)	(0.052)	(0.891)	(0.166)	(0.048)	(0.039)	(0.022)	(0.788)	(0.158)	(0.001)	(0.143)	(0.783)	(0.014)	(0.307)	(0.272)	(0.003)	(0.040)	(0.002)
Observations	1,615	1,819	1,819	1,819	1,819	1,819	1,819	1,789	1,791	1,826	1,825	1,814	1,828	1,827	1,743	1,762	1,757	1,757
R-squared	0.116	-0.310	-0.166	-0.243	-0.247	-0.278	-0.160	0.035	-0.003	-0.638	-1.086	-0.059	-2.293	-0.216	0.032	-0.147	-1.979	-0.770
Anderson-Rubin test	17.31	16.33	16.33	16.33	16.33	16.33	16.33	14.99	17.75	16.69	16.47	16.17	16.35	16.34	14.20	15.75	16.09	16.09
A-R F-test	6.523	2.301	1.185	1.904	1.864	2.059	2.081	0.980	0.182	6.921	9.869	2.386	22.37	3.037	5.016	5.335	13.93	4.388
p-value	0.000220	0.0754	0.314	0.127	0.134	0.104	0.101	0.401	0.909	0.000124	1.87e-06	0.0674	0	0.0281	0.00183	0.00117	5.59e-09	0.00439

standard errors in brackets, p-values in parentheses
*** p<0.01, ** p<0.05, * p<0.10

B Measurement error corrections

The estimates of the latent factor 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:

$$Y_i = \alpha\theta_i + \gamma X_i + \varepsilon_i \tag{4}$$

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) are statistically independent of V_i, the linear regression will produce biased estimates. In particular, Heckman et al. (2013) show that

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

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.

There is reason 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 variable estimates will also be biased if some of the controls are latent variables measured with error. In particular,

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

As in the case of linear regression, the terms in the correction matrix can be obtained from the estimates of the measurement system. In the case where there are more instruments than endogenous regressors, the formula is:

$$plim\ \hat{\beta}_{IV} = ((X'Z)_S(Z'Z)_S^{-1}(Z'X)_S)^{-1}((X'Z)_S(Z'Z)_S^{-1}(Z'X))\beta \tag{7}$$

where the term $(X'Z)_S$ denotes the sample covariance between X and Z and $(X'Z)$ denotes an unbiased estimator of the covariance between X and Z. These estimates can be obtained from the estimates of the measurement system.

Another remaining potential challenge to the validity of this study is the presence of

weak instruments or partially identified parameters. I use the reduce form method recently proposed by Chernozhukov and Hansen (2008b) which is robust to 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 use this approach to determine the significance of parental investment and domestic violence. Since the method requires eliminating the influence of other covariates prior to performing the tests, this adjustments is made using estimates that account for the possibility of measurement error as explained above. In particular, I 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. The method can also be used to determine the set of partially identified parameters when the regression model is under-identified. In particular, if the true equation is $Y_i = \alpha_1 X_{1,i} + \alpha_2 X_{2,i} + \varepsilon_i$ and Z_i is a valid instrument for both variables, then $Y_i - \alpha_1 X_{1,i} - \alpha_2 X_{2,i}$ must be independent of Z_i.

C Elegibility formula for conditional cash transfer program - JUNTOS

Households qualify for a CCT if they lived in one of the districts scheduled for expansion of the program and if the household had a mother or pregnant woman, a widower or custodian with children below 15 years of age. To determined the individual level eligibility to receive a CCT, the Peruvian Institute of Statistics estimated a logit model of the probability that a household is poor based of the 2001 and 2004 Peruvian households survey. In particular, the estimated model is:

$$y = \alpha + \beta X + \varepsilon$$

where Y equals 1 if the household is below the poverty line. X is a set of proxy variables that include: 1. x_1 = percent of adult females in the households, 2. x_2 = Percent of minors in the household that attend school, 3. x_3 = A dummy variable if the household uses industrial sources of energy (gas, electricity or kerosene), 4. x_4 = Number of household appliances absent in the household, 5. x_5 = Access to electricity, water and sewage, 6. x_6 = Lowest quality construction materials, 7. x_7 = Low quality construction materials, 8. x_8 = Mid quality construction materials. The estimated parameters used in the assignment program are:

$$y = -1.346104 + 1.183232 * x_1 + 0.2275956 * x_2 - 0.7623876 * x_3 + 0.4445512 * x_4 - 0.376869 * x_5 - 0.2593025 * x_6 - 0.8584362 * x_7 - 1.317246 * x_8$$

A household is considered poor, or eligible for the transfer, if $\hat{P} = \frac{exp(y)}{1+exp(y)} \geq .7567477$. I use this method, together with the deployment plan of the CCT, to determine if a household is predicted to receive a transfer. The variable $\hat{P}$ is used as an additional control in the regressions.

D Simulated and sample moments used in the calibration of Model 1

Mean	Observed	Simulated
Cognitive Development	0.035	0.044
Log of wage (mother)	0.389	0.217
Log of wage (father)	0.466	0.706
Hours worked for wage (mother)	21.628	27.477
Hours worked for wage (father)	47.545	54.497
Other income	16.784	1.736
Weakly consumption	253.129	178.849
Parental money investments	23.604	20.991
Reported domestic violence in 3rd wave	0.071	0.045
Reported domestic violence in 2nd wave	0.087	0.072
Asked for help regarding domestic violence (3rd wave)	0.109	0.101
Time investment (mother)	6.513	6.833
Knows children's friends' names	0.841	1.000
Encourage child to read (1,2,3 levels)	2.449	2.417
Help child with homework	0.623	1.000
Nonzero hours worked for wage (mother)	0.705	0.539
Nonzero hours worked for wage (father)	0.996	0.894
Nonzero hours worked for wage (mother & father)	0.701	0.434
Reported domestic violence in 2nd and 3rd wave	0.020	0.000
Reported domestic violence and asked for help in 3rd wave	0.017	0.023
Reported domestic violence in 2nd wave and asked for help in 3rd wave	0.017	0.000
Knows child's friends' name and Encourage to read sometimes	0.772	0.681
Knows child's friends' name and helps with homework	0.552	0.973
Encourages to read sometimes and helps with homework	0.596	0.682
Knows child's friends' name and Encourage to read frequently	0.445	0.446
Helps with homework and Encourage to read frequently	0.341	0.446
Reported domestic violence in 3rd wave X Maternal time investment	0.445	0.659
Did not report domestic violence in 3rd wave X Maternal time investment	6.068	6.174
Reported domestic violence in 2nd wave X Maternal time investment	0.571	0.562
Did not report domestic violence in 2nd wave X Maternal time investment	5.942	6.271
Reported domestic violence in 3rd wave and knows child's friends' names	0.056	0.043
Reported domestic violence in 3rd wave and encourages child to read sometimes	0.065	0.044
Reported domestic violence in 3rd wave and encourages child to read frequently	0.036	0.044
Reported domestic violence in 3rd wave and helps child with homework	0.039	0.045
Reported domestic violence in 2nd wave and knows child's friends' names	0.074	0.070

Reported domestic violence in 2nd wave and encourages child to read sometimes	0.081	0.070
Reported domestic violence in 2nd wave and encourages child to read frequently	0.039	0.037
Reported domestic violence in 2nd wave and helps child with homework	0.050	0.072
Asked for help regarding domestic violence and knows child's friends' names	0.092	0.098
Asked for help regarding domestic violence and encourages child to read sometimes	0.101	0.078
Asked for help regarding domestic violence and encourages child to read frequently	0.052	0.042
Asked for help regarding domestic violence and helps child with homework	0.074	0.101
Lottery choice equals 1	0.088	0.077
Lottery choice equals 2	0.103	0.122
Lottery choice equals 3	0.081	0.074
Lottery choice equals 4	0.118	0.104
Lottery choice equals 5	0.092	0.080
Lottery choice equals 6	0.519	0.543

Standard deviations	**Observed**	**Simulated**
Cognitive development index	0.796	0.764
Log of wage (mother)	1.342	1.039
Log of wage (father)	1.193	1.072
Hours worked for wage (mother)	23.997	32.532
Hours worked for wage (mother)	19.828	34.599
Other income	128.874	1.598
Weakly consumption	168.485	229.045
Parental money investments	50.134	30.037
Time investment (mother)	4.455	4.627

Correlations	**Observed**	**Simulated**
correlation of cognitive and risk attitude	-0.037	0.055
correlation of mother's and father's wages	0.374	0.120
correlation of mother's and father's hours worked	0.010	-0.135
correlation of mother's wage and mother's hours worked	-0.232	0.404
correlation of father's wage and father's hours worked	-0.045	0.167
correlation of father's wage and mother's hours worked	-0.031	-0.532
correlation of mother's wage and father's hours worked	0.090	-0.284

Conditional means of father's wages	**Observed**	**Simulated**
Father finished at least high school	0.941	0.868
Mother finished at least high school	1.036	0.846
Father finished at least primary school	0.004	0.565
Mother finished at least primary school	0.135	0.655

Father is at least 40 years old	0.443	0.700
Mother is at least 35 years old	0.455	0.707
Father is less than 40 years old	0.317	0.664
Mother is less than 35 years old	0.379	0.692

Conditional means of mother's wages	**Observed**	**Simulated**
Father finished at least high school	0.762	0.320
Mother finished at least high school	0.859	0.389
Father finished at least primary school	-0.301	0.056
Mother finished at least primary school	-0.167	0.074
Father is at least 40 years old	0.405	0.216
Mother is at least 35 years old	0.448	0.230
Father is less than 40 years old	0.304	0.184
Mother is less than 35 years old	0.186	0.181

Conditional mean of father's hours worked	**Observed**	**Simulated**
Father finished at least high school	49.814	55.160
Mother finished at least high school	50.894	53.130
Father finished at least primary school	44.902	53.992
Mother finished at least primary school	47.150	55.020
Father is at least 40 years old	46.663	54.980
Mother is at least 35 years old	47.552	54.824
Father is less than 40 years old	47.232	53.817
Mother is less than 35 years old	47.476	54.373

Conditional mean of mother's hours worked	**Observed**	**Simulated**
Father finished at least high school	23.122	26.886
Mother finished at least high school	23.071	28.748
Father finished at least primary school	22.177	27.930
Mother finished at least primary school	20.644	26.970
Father is at least 40 years old	21.614	27.034
Mother is at least 35 years old	24.284	27.182
Father is less than 40 years old	19.455	28.103
Mother is less than 35 years old	19.038	27.591

Other	**Observed**	**Simulated**
Time investment conditional on mother finishing HS	8.599	6.693
Time investment conditional on mother finishing primary education	5.404	6.887
Time investment conditional on father finishing HS	8.078	6.897

Time investment conditional on father finishing primary education	4.818	6.784
correlation of mother's time investment and cognitive development	0.272	0.129
correlation of mother's time investment and lottery choices	-0.009	0.105
correlation of monetary investment and cognitive development	0.140	0.224
correlation of mother's wage and father's hours worked	-0.006	-0.144
correlation of mothers wage and cognitive development	0.252	0.173
correlation of mother's wage and lottery choices	-0.019	-0.093
correlation of father's wage and cognitive development	0.226	0.189
correlation of father's wage and lottery choices	-0.003	0.124
correlation of violence and cognitive development	-0.062	-0.010
correlation of violence and lottery choices	-0.052	-0.048
correlation of mother's wage and violence	-0.031	-0.053
correlation of father's wage and violence	0.002	0.000

Conditional mean of domestic violence	**Observed**	**Simulated**
Father finished at least high school	0.256	0.211
Mother finished at least high school	0.253	0.197
Father finished at least primary school	0.234	0.224
Mother finished at least primary school	0.318	0.223
Father is at least 40 years old	0.260	0.224
Mother is at least 35 years old	0.273	0.224
Father is less than 40 years old	0.259	0.212
Mother is less than 35 years old	0.249	0.214

E A strategic model of household decisions with domestic violence

In this section I discuss the results of an alternative structural model of household dynamics in which domestic violence is instrumental. This exercise is intended to probe the sensitivity of results to modelling assumptions. In this model husbands are principals that sometimes use violence to extract work from wives, the agents. The model builds on Weinberg (2001)'s research on the use of corporal punishment by parents. Husbands care about the time wives devote to households chores (t_h), but this effort is not observable.[25] Husbands only receive a signal, high or low, which is correlated with effort. The probability of receiving a high signal is increasing in the time a wife devotes to household chores. In order to extract effort, husbands make transfers conditional on the observed signal. These transfers are above the minimum required level set by law or custom.[26] In this model, wives do not derive any utility from household chores. They perform these tasks either because they receive compensation or to avoid violence. Husbands are altruistic towards their wives (love which is assumed not reciprocated for simplicity). Husbands refraining from violence need to compensate for their wives opportunity cost of time. Husbands unable to compensate their wives enough trade-off between enjoying the benefits of household chores and the utility cost imposed on their wives.

I will sketch the main elements of the model and present a complete derivation of the estimated model in Appendix F. Using the notation from the previous section, mothers are assumed to solve the problem below,

$$Max \;\; \alpha_c ln(c_m) + \alpha_l ln(l_m) + \alpha_\theta ln(\theta_1) + \alpha_{\sigma_1} ln(\sigma_1) - \alpha_V V \tag{8}$$

$$c_m + I + w_m(l_m + \tau_m + t_h) \leq Y_m + \underline{Y} + \Phi(t_h)\Delta Y + w_m T \tag{9}$$

$$ln\theta_1 = A + a_\theta ln(\theta_0) + a_{\theta_m} ln(\theta_m) + a_{\tau_m} ln(\tau_m) + a_I ln(I) + a_V V + a_X X + \epsilon_\theta \tag{10}$$

$$ln\sigma_1 = B + b_\sigma ln(\sigma_0) + b_{\theta_m} ln(\theta_m) + b_{\tau_m} ln(\tau_m) + b_I ln(I) + b_V V + b_X X + \epsilon_\sigma \tag{11}$$

Wives/mothers derive utility from consumption (c_m), leisure (l_m), the cognitive development of the child (θ_1) and the child's preferences (σ_1) subject to a budget constraint and technology constraints. I assume, for the moment, that violence (V) is 0. The transfer wives receive from fathers is $\underline{Y} + \Delta Y$ if the signal is good and $\underline{Y}$ if the signal is bad. The probability of obtaining a good signal is $\Phi(t_h)$ where $\Phi(.)$ is a cumulative distribution

[25] This assumption is reasonable in the current context. Most husbands in the sample work and only observe signals of their wife's efforts like cleanliness of the household, quality of meals, etc.

[26] In Peru, fathers are required to give at least a third of their earned income to ex-wives and the law requires that transfers are made conditional on the number of children. This is an extra parameter in the model.

function. The budget constraint is written under the assumption that wives can obtain an actuarially fair insurance on the signal-contingent transfers. This assumption simplifies the analysis greatly and explains the way the budget constraint is written. Wives have then an opportunity to obtain transfers from their husbands by performing household chores and husbands can *choose* the level of t_h by varying ΔY.

Let $V_m(w_m, Y_m, \underline{Y}, \Delta Y)$ be the indirect utility function of the wife when facing market wage w_m, independent income Y_m and contract $(\underline{Y}, \Delta Y)$. The problem that the husband solves is:

$$max \;\; \beta_c ln(c_f) + \beta_l ln(l_f) + \beta_h ln(t_h) + \beta_m V_m(w_m, Y_m, \underline{Y}, \Delta Y) \tag{12}$$

$$c_f + w_f l_f + \underline{Y} + \Delta Y \leq Y_f + w_f T \tag{13}$$

$$t_h \;\; is \;\; optimal \tag{14}$$

The equation above assumes that husbands can insure income outlays as wives do. Again, this is done to simplify the analysis and estimations. Note that husbands care about their children only because they care about their wives' utility.

Suppose that $\Phi(t_h) = \frac{t_h}{T}$. That is, the probability of receiving a good signal is uniformly distributed. Since wives do not derive utility from performing household chores, they will find working for a wage or for their husbands as perfect substitutes. If a husband cannot pay their wives' market wage, they will not provide any house work. Since husbands consider household chores essential goods, they will use violence as a way to extract effort from their wives any time this is more profitable. In other words, if wives dislike violence, husbands can use violence whenever a bad signal is observed. The "optimal" amount of violence will depend on the preference parameters of both husbands and wives. Even in this simple set-up, the model does not have a closed-form solution. Additional details on the solution of the model are provided in F.

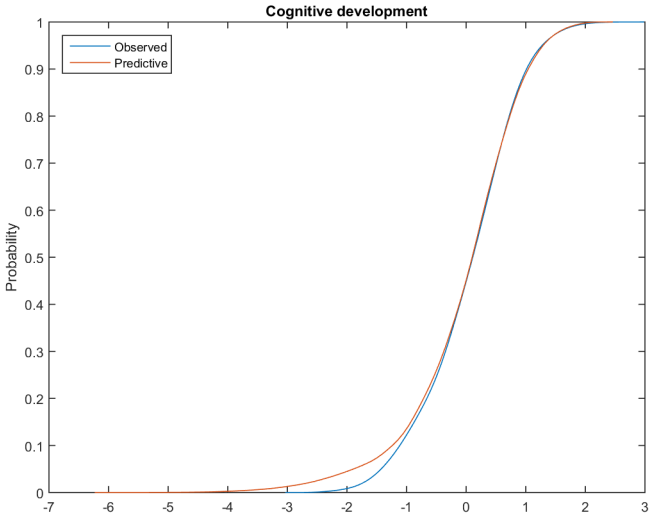
Table E.2 in this Appendix shows the fit of the model for the 122 moments used to calibrate it.[27] While this model is able to reproduce many features of the data, the fit is worse than the model in the previous section. The weighted sum of moments (divided by the number of moments) is over two and half times larger than in the previous model. Figure E.1 compares the simulated and observed distribution of the cognitive development index and shows that the model fit is less precise. Regarding the prevalence of domestic violence, Table E.2 in Appendix F shows that the model predicts this variable reasonably well.

[27]The consumption of the wife and husband are separate in this specification adding two extra moments to the model, one for the mean and one for the variance.

Table E.1 presents estimates of preference parameters, the cognitive development function and the risk attitudes function. In this version of the model, only mothers care about the cognitive development and preferences of their children. While the weight of cognitive development in the mother's utility is small, there is a high degree of preferences heterogeneity as expressed by the coefficient of variation of the preference parameter. I find that the parameters of the cognitive development function and risk attitudes function are quite similar across models with the exception that this model estimates the effect of domestic violence on cognitive development to be much larger.

In sum, the structural estimation produce similar results as the instrumental variable approach.

Figure E.1: Model 2. Cumulative Distribution of Observed and predicted index of cognitive development



Mean	Observed	Simulated
Cognitive Development	0.035	-0.050
Log of wage (mother)	0.389	0.342
Log of wage (father)	0.466	0.567
Hours worked for wage (mother)	21.628	29.984
Hours worked for wage (father)	47.545	50.410
Other income	16.784	6.575
Weakly consumption (mother)	84.376	71.334
Weakly consumption (father)	168.753	177.031
Parental money investments	23.604	0.036
Reported domestic violence in 3rd wave	0.071	0.100
Reported domestic violence in 2nd wave	0.087	0.080
Asked for help regarding domestic violence (3rd wave)	0.109	0.224
Time investment (mother)	6.513	0.047
Knows children's friends' names	0.841	1.000
Encourage child to read (1,2,3 levels)	2.449	1.938
Help child with homework	0.623	0.240
Nonzero hours worked for wage (mother)	0.705	0.934
Nonzero hours worked for wage (father)	0.996	0.981
Nonzero hours worked for wage (mother & father)	0.701	0.915
Reported domestic violence in 2nd and 3rd wave	0.020	0.060
Reported domestic violence and asked for help in 3rd wave	0.017	0.080
Reported domestic violence in 2nd wave and asked for help in 3rd wave	0.017	0.060
Knows child's friends' name and Encourage to read sometimes	0.772	0.972
Knows child's friends' name and helps with homework	0.552	0.233
Encourages to read sometimes and helps with homework	0.596	0.234
Knows child's friends' name and Encourage to read frequently	0.445	0.064
Helps with homework and Encourage to read frequently	0.341	0.019
Reported domestic violence in 3rd wave X Maternal time investment	0.445	0.001
Did not report domestic violence in 3rd wave X Maternal time investment	6.068	0.046
Reported domestic violence in 2nd wave X Maternal time investment	0.571	0.000
Did not report domestic violence in 2nd wave X Maternal time investment	5.942	0.046
Reported domestic violence in 3rd wave and knows child's friends' names	0.056	0.097
Reported domestic violence in 3rd wave and encourages child to read sometimes	0.065	0.097
Reported domestic violence in 3rd wave and encourages child to read frequently	0.036	0.000
Reported domestic violence in 3rd wave and helps child with homework	0.039	0.000
Reported domestic violence in 2nd wave and knows child's friends' names	0.074	0.078
Reported domestic violence in 2nd wave and encourages child to read sometimes	0.081	0.078
Reported domestic violence in 2nd wave and encourages child to read frequently	0.039	0.000

Reported domestic violence in 2nd wave and helps child with homework	0.050	0.000
Asked for help regarding domestic violence and knows child's friends' names	0.092	0.218
Asked for help regarding domestic violence and encourages child to read sometimes	0.101	0.218
Asked for help regarding domestic violence and encourages child to read frequently	0.052	0.000
Asked for help regarding domestic violence and helps child with homework	0.074	0.040
Lottery choice equals 1	0.088	0.150
Lottery choice equals 2	0.103	0.133
Lottery choice equals 3	0.081	0.017
Lottery choice equals 4	0.118	0.042
Lottery choice equals 5	0.092	0.089
Lottery choice equals 6	0.519	0.569

Standard deviations	**Observed**	**Simulated**
Cognitive development index	0.796	0.972
Log of wage (mother)	1.342	1.044
Log of wage (father)	1.193	1.083
Hours worked for wage (mother)	23.997	34.251
Hours worked for wage (mother)	19.828	34.307
Other income	128.874	16.671
Weakly consumption (mother)	56.162	153.540
Weakly consumption (father)	112.323	282.496
Parental money investments	50.134	0.105
Time investment (mother)	4.455	0.048

Correlations	**Observed**	**Simulated**
correlation of cognitive and risk attitude	-0.037	0.319
correlation of mother's and father's wages	0.374	0.122
correlation of mother's and father's hours worked	0.010	-0.363
correlation of mother's wage and mother's hours worked	-0.232	0.017
correlation of father's wage and father's hours worked	-0.045	0.238
correlation of father's wage and mother's hours worked	-0.031	-0.144
correlation of mother's wage and father's hours worked	0.090	-0.469

Conditional means of father's wages	**Observed**	**Simulated**
Father finished at least high school	0.941	0.780
Mother finished at least high school	1.036	0.752
Father finished at least primary school	0.004	0.383
Mother finished at least primary school	0.135	0.505
Father is at least 40 years old	0.443	0.502

Mother is at least 35 years old	0.455	0.528
Father is less than 40 years old	0.317	0.564
Mother is less than 35 years old	0.379	0.583

Conditional means of mother's wages	**Observed**	**Simulated**
Father finished at least high school	0.762	0.456
Mother finished at least high school	0.859	0.532
Father finished at least primary school	-0.301	0.163
Mother finished at least primary school	-0.167	0.185
Father is at least 40 years old	0.405	0.333
Mother is at least 35 years old	0.448	0.347
Father is less than 40 years old	0.304	0.314
Mother is less than 35 years old	0.186	0.312

Conditional mean of father's hours worked	**Observed**	**Simulated**
Father finished at least high school	49.814	50.433
Mother finished at least high school	50.894	50.430
Father finished at least primary school	44.902	50.391
Mother finished at least primary school	47.150	50.404
Father is at least 40 years old	46.663	50.400
Mother is at least 35 years old	47.552	50.404
Father is less than 40 years old	47.232	50.411
Mother is less than 35 years old	47.476	50.413

Conditional mean of mother's hours worked	**Observed**	**Simulated**
Father finished at least high school	23.122	30.108
Mother finished at least high school	23.071	30.090
Father finished at least primary school	22.177	30.004
Mother finished at least primary school	20.644	29.985
Father is at least 40 years old	21.614	29.911
Mother is at least 35 years old	24.284	29.946
Father is less than 40 years old	19.455	29.998
Mother is less than 35 years old	19.038	30.005

Other	**Observed**	**Simulated**
Time investment conditional on mother finishing HS	8.599	0.047
Time investment conditional on mother finishing primary education	5.404	0.047
Time investment conditional on father finishing HS	8.078	0.047
Time investment conditional on father finishing primary education	4.818	0.047

correlation of mother's time investment and cognitive development	0.272	0.222
correlation of mother's time investment and lottery choices	-0.009	0.073
correlation of monetary investment and cognitive development	0.140	0.087
correlation of mother's wage and father's hours worked	-0.006	-0.173
correlation of mothers wage and cognitive development	0.252	0.104
correlation of mother's wage and lottery choices	-0.019	-0.168
correlation of father's wage and cognitive development	0.226	-0.145
correlation of father's wage and lottery choices	-0.003	-0.090
correlation of violence and cognitive development	-0.062	-0.503
correlation of violence and lottery choices	-0.052	-0.489
correlation of mother's wage and violence	-0.031	-0.134
correlation of father's wage and violence	0.002	0.248

Conditional mean of domestic violence	**Observed**	**Simulated**
Father finished at least high school	0.256	0.400
Mother finished at least high school	0.253	0.401
Father finished at least primary school	0.234	0.401
Mother finished at least primary school	0.318	0.404
Father is at least 40 years old	0.260	0.407
Mother is at least 35 years old	0.273	0.406
Father is less than 40 years old	0.259	0.404
Mother is less than 35 years old	0.249	0.403

Table E.1: Model 2: Structural parameters

Preference parameters			
Variable	coefficient	s.e.	CV
Wife's preferences			
α_C (Consumption)	0.5740	0.0044	4.88
α_l (Leisure)	0.3660	0.0039	2.04
α_θ (Cognitive development)	0.0020	0.0000	468.82
α_σ (Risk attitudes)	0.0005	0.0000	
α_V (Domestic violence)	-26.0211	0.3614	0.03
Husband's preferences			
β_C (Consumption)	0.2271	0.0001	6.31
β_l (Leisure)	0.6794	0.0002	2.70
β_h (Wife's housework)	0.0715	0.0000	26.87
β_m (Wife's utility)	0.0220	0.0000	
Cognitive production function			
Variable	coefficient	s.e.	
a_{τ_m} (Mother's investment (time))	0.0442	0.0011	
a_I (Parental investment (money))	0.0131	0.0000	
a_{θ_0} (Cognitive development (lagged))	1.5436	0.0007	
a_V (Domestic Violence)	-0.0792	0.0001	
a_{θ_m} (Mother's capital)	-0.1091	0.0001	
a_{hh} (Household size)	-0.0437	0.0000	
a_ω (Wealth)	-0.0350	0.0000	
Risk attitudes function			
Variable	coefficient	s.e.	
b_{τ_m} (Mother's investment (time))	0.0170	0.0000	
b_I (Parental investment (money))	0.0004	0.0000	
b_{θ_0} (Cognitive development (lagged))	0.0235	0.0000	
b_V (Domestic Violence)	-0.2596	0.0003	
b_{θ_m} (Mother's capital)	0.0017	0.0000	
b_{hh} (Household size)	-0.1323	0.0001	
b_ω (Wealth)	0.0890	0.0001	

Standard errors are calculated as the standard deviation of parameter estimates of 20 bootstrap iterations.

F An alternative model of household decisions - Derivations

No violence. As a first approximation, I assume that $\Phi(t_h) = \frac{t_c}{T}$. The problem of the mother when violence is exogenous is:

$$Max \;\; \alpha_c ln(c_m) + \alpha_l ln(T - \tau_m - t_h - t_w) + \alpha_\theta ln(\theta_1) + \alpha_{\sigma_1} ln(\sigma_1) - \alpha_\mathcal{V}\mathcal{V} \tag{15}$$

$$c_m + I \leq Y_m + \underline{Y} + \frac{\Delta Y}{T} t_h + w_m t_w \tag{16}$$

$$ln\theta_1 = A + a_\theta ln(\theta_0) + a_{\theta_m} ln(\theta_m) + a_{\tau_m} ln(\tau_m) + a_I ln(I) + a_\mathcal{V}\mathcal{V} + a_X X + \epsilon_\theta \tag{17}$$

$$ln\sigma_1 = B + b_\sigma ln(\sigma_0) + b_{\theta_m} ln(\theta_m) + b_{\tau_m} ln(\tau_m) + b_I ln(I) + b_\mathcal{V}\mathcal{V} + b_X X + \epsilon_\sigma \tag{18}$$

This problem has a corner solution with $t_h = 0$ if $w_m > \frac{\Delta Y}{T}$. If t_h is an essential good for the husband, then $\frac{\Delta Y}{T} > w^* > w_m$ if this contract is to be used. Note that in this specific case, the father acts as if he is hiring the mother to work at a wage $\frac{\Delta Y}{T}$.

The FOCs for this special case are:

$$\frac{\alpha_c}{c_m} - \lambda = 0 \tag{19}$$

$$-\frac{\alpha_l}{T - \tau_m - t_h} + \lambda \frac{\Delta Y}{T} = 0 \tag{20}$$

$$-\frac{\alpha_l}{T - \tau_m - t_h} + \frac{\alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}}{\tau_m} = 0 \tag{21}$$

$$\frac{\alpha_\theta a_I + \alpha_\sigma b_I}{I} - \lambda = 0 \tag{22}$$

$$c_m + I = Y_m + \underline{Y} + \frac{\Delta Y}{T} t_h \tag{23}$$

and $t_h(Y_m, \underline{Y}, \Delta Y) = \frac{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I}{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}} T - \frac{\alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}}{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}} \frac{Y_m + \underline{Y}}{\frac{\Delta Y}{T}}$.
Or, $t_h = \xi T - (1-\xi)\frac{Y_m + \underline{Y}}{\Delta Y} T$. Then $l_m + \tau_m = (1-\xi)T + (1-\xi)\frac{Y_m + \underline{Y}}{\Delta Y} T = (1-\xi)\frac{Y_m + \underline{Y} + \Delta Y}{\Delta Y} T$

To derive the complete solution of the mother's problem, an expression is obtained: $Y_m + \underline{Y} + \frac{\Delta Y}{T} t_h$. That is, $Y_m + \underline{Y} + \xi \Delta Y - (1-\xi)(Y_m + \underline{Y}) = \xi(Y_m + \underline{Y} + \Delta Y) = \frac{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I}{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}} (Y_m + \underline{Y} + \Delta Y)$.

This implies that $c_m = \frac{\alpha_c}{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}} (Y_m + \underline{Y} + \Delta Y)$, $I = \frac{\alpha_\theta a_I + \alpha_\sigma b_I}{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}} (Y_m + \underline{Y} + \Delta Y)$, and $\lambda = \frac{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}}{Y_m + \underline{Y} + \Delta Y}$.

The father's problem is:

$$max \;\; \beta_c ln(c_f) + \beta_l ln(l_f) + \beta_h ln(t_h(Y_m, \underline{Y}, \Delta Y)) + \beta_m V_m(Y_m, \underline{Y}, \Delta Y) \tag{24}$$

$$c_f + w_f l_f + \underline{Y} + \frac{\Delta Y}{T} t_h(Y_m, \underline{Y}, \Delta Y) \leq Y_f + w_f T \tag{25}$$

A simpler version of this model considers that there is a minimum transfer to be made to mothers, $\underline{Y}$. This reduces the complexity of the model and gives the following FOCs.

$$\frac{\beta_c}{c} - \lambda = 0 \tag{26}$$

$$\frac{\beta_l}{l_f} - \lambda w_f = 0 \tag{27}$$

$$\frac{\beta_h}{t_h(Y_m, \underline{Y}, \Delta Y)} \frac{\partial t_h}{\partial \Delta Y} + \beta_m \lambda^* t_h(Y_m, \underline{Y}, \Delta Y) - \lambda \xi = 0 \tag{28}$$

$$c_f + w_f l_f + \xi(\underline{Y} + \Delta Y) - (1 - \xi) Y_m \leq Y_f + w_f T \tag{29}$$

$$\lambda^* = \frac{\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m}}{Y_m + \underline{Y} + \Delta Y} \tag{30}$$

The model has a nonlinear solution.

We have that $t_h = \xi T - (1 - \xi) \frac{Y_m + \underline{Y}}{\Delta Y} T$. After substitutions:

$\frac{\beta_h (1-\xi)(Y_m + \underline{Y})}{\xi \Delta Y (\xi \Delta Y - (1-\xi)(Y_m + \underline{Y}))} + \frac{\beta_m (\alpha_c + \alpha_\theta a_I + \alpha_\sigma b_I + \alpha_l + \alpha_\theta a_{\tau_m} + \alpha_\sigma b_{\tau_m})(\xi \Delta Y - (1-\xi)(Y_m + \underline{Y}))T}{(Y_m + \underline{Y} + \Delta Y)\Delta Y} = \lambda(\Delta Y)$

ΔY solves the following equation:

$\frac{\beta_c + \beta_l}{\lambda(\Delta Y)} + \xi(Y_m + \underline{Y} + \Delta Y) = Y_f + w_f T + Y_m$

Violence. I consider now the situation in which a father cannot implement the optimal contract due to the existence of a minimum transfer constraint. As before, fathers make a minimum transfer to mothers in the amount $\overline{Y}$ unconditionally and use a level of domestic violence $\mathcal{V}$ if they observed a bad signal.

After collecting terms, the mothers' indirect utility function is defined as:

$$V_m(w_m, Y_m, \underline{Y}, \mathcal{V}) = max_{c_m, l_m, t_h, \tau_m, I} \{\alpha_c ln(c_m) + \alpha_l ln(l_m) + (\alpha_\theta a_1 + \alpha_{\sigma_1} b_1) ln(\tau_m) +$$
$$(\alpha_\theta a_2 + \alpha_{\sigma_1} b_2) ln(I) - \gamma_\mathcal{V}(1 - \frac{t_h}{T})\mathcal{V} : c_m + I + w_m(l_m + \tau_m + t_h) \leq Y_m + \underline{Y} + w_m T\}$$

where $\gamma_\mathcal{V} = \alpha_\mathcal{V} + \alpha_\theta a_\mathcal{V} + \alpha_\sigma b_\mathcal{V}$. In this set-up, the utility of the mother is quasi-linear on household chores which simplifies the analysis enormously. The optimal decisions of the mother are:

$$c_m = \frac{\alpha_c}{\gamma_{\mathcal{V}}\mathcal{V}} w_m T \tag{31}$$

$$l_m = \frac{\alpha_l}{\gamma_{\mathcal{V}}\mathcal{V}} T \tag{32}$$

$$\tau_m = \frac{\alpha_\theta a_1 + \alpha_{\sigma_1} b_1}{\gamma_{\mathcal{V}}\mathcal{V}} T \tag{33}$$

$$I = \frac{\alpha_\theta a_2 + \alpha_{\sigma_1} b_2}{\gamma_{\mathcal{V}}\mathcal{V}} w_m T \tag{34}$$

$$t_h = \frac{Y_m + \underline{Y}}{w_m} + \frac{\gamma_{\mathcal{V}}\mathcal{V} - (\alpha_c + \alpha_l + \alpha_\theta a_1 + \alpha_{\sigma_1} b_1 + \alpha_\theta a_2 + \alpha_{\sigma_1} b_2)}{\gamma_{\mathcal{V}}\mathcal{V}} T \tag{35}$$

If the mother does not work ($t_w = 0$), then: $c_m = \frac{\alpha_c}{\alpha_c + \alpha_\theta a_2 + \alpha_{\sigma_1} b_2}(Y_m + \underline{Y})$, $I = \frac{\alpha_\theta a_2 + \alpha_{\sigma_1} b_2}{\alpha_c + \alpha_\theta a_2 + \alpha_{\sigma_1} b_2}(Y_m + \underline{Y})$, $\tau_m = \frac{\alpha_\theta a_1 + \alpha_{\sigma_1} b_1}{\alpha_l} \frac{1}{\gamma_{\mathcal{V}}\mathcal{V}} T$, and $t_h = T - \frac{\alpha_l + \alpha_\theta a_1 + \alpha_{\sigma_1} b_1}{\alpha_l} \frac{1}{\gamma_{\mathcal{V}}\mathcal{V}} T$.

The problem of the father is:

$$max \;\; \beta_c ln(c_f) + \beta_l ln(l_f) + \beta_h ln(t_h) + \beta_m V_m(w_m, Y_m, \underline{Y}, \mathcal{V}) \tag{36}$$

$$c_f + w_f l_f \leq Y_f + w_f T - \underline{Y} \tag{37}$$

The optimal level of violence is separate from the consumption decisions since violence has an emotional cost, not a monetary one. The optimal level of $\mathcal{V}$ is the solution of the following equation:

$$\frac{\beta_h}{t_h(w_m, Y_m, \underline{Y}, \mathcal{V})} \frac{\partial t_h(w_m, Y_m, \underline{Y}, \mathcal{V})}{\partial \mathcal{V}} - \gamma_{\mathcal{V}}(1 - \frac{t_h(w_m, Y_m, \underline{Y}, \mathcal{V})}{T}) = 0 \tag{38}$$

where $t_h(w_m, Y_m, \underline{Y}, \mathcal{V})$ is the optimal decision of the mother facing parameters $(w_m, Y_m, \underline{Y}, \mathcal{V})$ and $\frac{\partial t_h}{\partial \mathcal{V}} = \frac{Y_m + \underline{Y}}{w_m \mathcal{V}} - \frac{t_h}{\mathcal{V}} > 0$. (If $t_w = 0$, then $\frac{\partial t_h}{\partial \mathcal{V}} = \frac{T - t_h}{\mathcal{V}} > 0$) The solution for c_f and l_f are standard. This model has some interesting predictions. First, violence can occur even if both fathers and mothers are relatively rich. Violence can occur if the father does not have the resources to compensate for the mother's time. In that situation, a father will use violence to extract work from the mother. The model can also explain household relationships between parents and children as in Weinberg (2001).