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An economic analysis of tiger parenting: Evidence from child developmental delay or learning disability

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A R T I C L E I N F O

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A B S T R A C T

A controversy over "tiger parenting" was provoked by the book "Battle Hymn of the Tiger Mother." While the media and public often focus on its cultural implications and effectiveness in child-bearing, and economics literature focuses on the choice of parenting style with respect to economic conditions, this article takes a step further and examines the operation of parenting style by studying the economic implications related to a common method used by "tiger parents" in parenting their children: punishment. We argue that if parents employ punishment as an instrument to discipline their children to exert more effort in their human capital investment, the possibility of punishment should be increasing in children's capability. We test this hypothesis by investigating the effect of children's developmental delay or learning disabilities on the likelihood of parents punishing their children in case their academic results are below expectations, and find supportive evidence. Surprisingly, we find no evidence on parents being more kind to children with development deficiency.

"If the next time's not perfect, I'm going to take all your stuffed animals and burn them!" -Battle Hymn of the Tiger Mother, the tiger mother said to her daughter at the piano

"…assume it's because the child didn't work hard enough. That's why the solution to substandard performance is always to excoriate, punish and shame the child." -Battle Hymn of the Tiger Mother

1. Introduction

"What is the best way to raise my children?" This question is common among nearly all parents. On the bookshelves of many parents who have the question in mind, one may find the "Battle Hymn of the Tiger Mother," the memoir of Yale Law Professor Amy Chua on parenting her two daughters (Chua, 2011). In the book, Chua calls herself a "tiger mother" and describes her strict supervision of her daughters' development, from practicing piano songs perfectly to never getting any grades lower than A. Her methods include excoriating, punishing, and shaming her daughters. Her parenting methods have provoked a huge controversy over "tiger parenting" in the media and the academia. One aspect of the controversy is cultural because Chua's book contrasts "Chinese parents" against "Western parents," and some follow-up reports and articles in the media highlight the cultural divergence. In a TV program produced by the BBC, Sally, a Chinese-British tiger mom of a six-year-old boy said, "He only does about three hours homework a night – plenty of time to play!" (Wonderland, 2012).

Some media outlets have focused on the cultural gap, whereas others are more interested in exploring the social and economic factors and implications of "tiger parenting." An article in TIME magazine argues that "tiger parenting" "revealed American fears about losing ground to China and preparing our (their) kids to survive in the global economy" (Paul, 2011). Public discussions are enticed in part by these cultural, social, and economic factors behind "tiger parenting." However, debates on the effectiveness of "tiger parenting" are equally attractive to the public, and probably even more attractive to parents. An article in The Economist reports that although "tiger parenting" drives the children to work harder, "children also suffer from poorer self-images and more conflicted relationships with their parents" ("Revenge of the Tiger Mother", 2014).

The controversy over "tiger parenting" has also triggered the latest wave of literature on the economics of parenting. We describe the development of this field in two waves. The first wave started with a study by Weinberg (2001), who regards corporal punishment as an instrument to influence the behavior of children. He argues that corporal punishment is common in low-income groups because the "parents' ability to mold their children's behavior through pecuniary incentives is limited at low income." Weinberg uses data from the 1997 Child Development

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Supplement (CDS) of the Panel Study of Income Dynamics (PSID) to support this hypothesis. Akabayashi (2006) proposes a dynamic equilibrium model that analyzes child abuse.[1] Later, Hao et al. (2008) develop a repeated two-stage game in which parents may punish older children for their adolescent risk-taking behavior when several young siblings are present in the household. They test their hypothesis by regarding a reduction in parental "co-residence transfer" and "financial transfer" after the age of 18 as punishment to adolescent risk-taking behavior and find support to their hypothesis.

The second wave of studies triggered by the controversy of "tiger parenting" comprises those of Doepke and Zilibotti (2017) and Doepke and Zilibotti (2019). They develop a theoretical model that predicts the choices among three alternative parenting styles (authoritarian, authoritative, and permissive) under different economic conditions. One of the predictions of their model is that an increase in income inequality raises the return of education, which induces the parents to choose an authoritative style (intensive parenting to mold children's preferences). Their model also predicts that more educated parents are more likely to switch from an authoritarian style[2] (direct impositions of parents' will on children) to an authoritative style than less educated parents. Although Doepke and Zilibotti (2017) provide important insights into the choice among alternative parenting styles, the operation of these styles remains a black box.

Our study is an attempt to take one further step in examining the parenting operation. Specifically, it contributes to the literature in five aspects. First, we develop a simple economic analysis on a common instrument of "tiger parents" in parenting or authoritarian parenting style, punishing their children, in the context of human capital investment. In other words, we attempt to look into the black box of the operation of the authoritarian parenting style in Doepke and Zilibotti (2019). Our study is different from the first wave of studies in the literature. While Weinberg (2001) and Akabayashi (2006) focus on spanking children and child maltreatment, respectively, and Hao et al. (2008) concentrate on adolescent risk-taking behavior, our study provides a more general explanation of punishment in a human capital investment framework and takes parent's utility cost in punishing the child into account. Our approach generates predictions that cannot be derived from previous studies. Second, this study attempts to consider the productivity of the children's effort in their human capital investment in analyzing parenting behavior. We argue that this productivity would determine the return of punishing the child and affects the parent's action. Third, this study contributes to the literature by estimating the effects of child development deficiency on parenting behavior. Fourth, we test the negative effect of parent's education level on the likelihood of punishment, which is indirectly predicted by Doepke and Zilibotti (2017). Fifth, we test whether parents are kinder to children with developmental delay.

This article derives some economic predictions with supporting evidence on several aspects of "tiger parenting."[3] Specifically, we focus on one key method used by "tiger parent" on parenting their children: punishment. We argue that if parents employ punishment as an instrument to discipline their children to exert more effort in their human capital investment, the probability of punishment should increase when the children's capability is higher. Thus, if the capability of a child is low, the return from punishing the child will be low. Therefore, the incentive of the parents to punish the child should also be low. To test our hypothesis, we use a dataset containing information on the likelihood of punishing the child and whether the child has a developmental delay or learning disability (DDLD). According to Michigan Medicine, "Developmental Delay (DD) is when the child does not reach their development milestones at the expected times. It is an ongoing major or minor delay in the process of development. If your child is temporarily lagging behind, that is not called developmental delay. Delay can occur in one or many areas—for example, gross or fine motor, language, social, or thinking skills. … Developmental Delay is most often a diagnosis made by a doctor based on strict guidelines. … Developmental delay can have many different causes, such as genetic causes (like Down syndrome), or complications of pregnancy and birth (like prematurity or infections). Often, however, the specific cause is unknown" (Boyse, 2010). According to the Learning Disabilities Association of America, "Learning disabilities (LD) are due to genetic and/or neurobiological factors that alter brain functioning in a manner which affects one or more cognitive processes related to learning. These processing problems can interfere with learning basic skills such as reading, writing and/or math. They can also interfere with higher level skills such as organization, time planning, abstract reasoning, long or short term memory and attention" (Learning Disabilities Association of America, n.d.). For a child suffering from DDLD, the parent knows that increasing the child's level of effort after being punished by his parent is expected to yield a lower return than other children. Thus, the incentive to punish the child is low. This implication is supported by evidence from the CDS of the PSID.

Our focus on punishment also provides us with the opportunity to test the negative effect of parent's education level on the likelihood of punishment, which is indirectly predicted by Doepke and Zilibotti's (2017) model (DZ model). Doepke and Zilibotti's (2017) predicts that more educated parents are more likely to switch from an authoritarian to an authoritative style than less educated parents. Potential punishment, which is an instrument to force children to obey, constitutes a threat to children and enforces the imposition of parent's will on children. This method is a clear demonstration of the authoritarian parenting style (imposing parents' will on children), but not that of the authoritative style (intensive parenting for molding the children's preferences). Thus, the DZ model indirectly predicts a negative effect of the parents' education level on the likelihood of punishment. This study finds some supportive evidence of this prediction.

The rest of the paper is organized as follows. Section 2 presents a simple model that illustrates how a parent chooses the probability of punishment to force his/her child to exert more effort into his/her human capital investment, and derives the comparative static relationship. Section 3 describes the model specifications and data. Section 4 reports the empirical results. Section 5 conducts the robustness tests. Finally, Section 6 elaborates on the conclusion.

2. An illustrating model

In this section, we present a simple model to capture the main points in this study and guide the empirical study presented in later sections. We consider a child who maximizes his/her utility by deciding on the amount of effort for his/her human capital investment and faces a tradeoff between the utility cost of his/her current effort and expected return on his/her human capital in adulthood. The parent is paternalistic and would like his/her child to work harder because he/she values the child's current utility less than the child. The parent is a "tiger" and may discipline the child to work harder (exert more effort) by choosing the probability of punishment.[4] To simplify the problem, the model does

[1] Akabayashi (2006) defines child abuse as "a dynamic parent–child relationship where the parent unreasonably overestimates the child's ability, tends to form a negatively biased view of the child's behavior, and maintains or excessively increases negatively biased (punitive) interactions." This definition is closer to child maltreatment than corporal punishment.

[2] By Chua's description (Chua, 2011), tiger parenting is largely overlapping with authoritarian parenting style.

[3] This article does not cover discussions on the effectiveness of "tiger parenting" on children's human capital accumulation.

[4] A good extension of this study is to examine whether encouraging children or giving them compensation when they exert effort would have the same effect as punishment. We believe that encouragement may have a similar effect. To keep this paper simple and concise, we do not incorporate encouragement into this study. More importantly, we do not have a comparable variable on encouragement or compensation in the data.

not involve resource allocation between the parent and the child, and the discount rate is assumed to be 0.

We consider a household consisting of a parent and a child who are both risk-neutral. We view their decisions to be made sequentially. The parent first chooses the probability of punishment. Then, the child chooses the amount of effort. By backward induction, we solve the child's optimization problem first and then solve the parent's problem. The child lives through two periods: the childhood (current) period and the adulthood (future) period. His/her utility function is given by

$$\max_{\{x\}} \; au(x, \delta p(h)) + v(h) \tag{1}$$

This utility function captures the trade-off between the utility cost of his/her current effort and the expected return on his/her human capital in adulthood. The first term is the childhood utility. a is a parameter larger than 1 and captures how the child places heavier weight on his current period utility than the parent. u is a function of x and $\delta p(h)$. x is the amount of effort exerted for human capital investment. We assume that $u_1 < 0$ and $u_{11} < 0$. $P(h)$ is the severity of punishment and is a function of h. We assume $p(h) \geq 0$.[5] h is the human capital stock $h = rx + \varepsilon$, where ε is a mean zero error term drawn from a distribution and r is a parameter that represents the productivity of the effort on building human capital. Moreover, we assume $p' < 0$ and $p'' > 0$. Intuitively, if the child is lazy (small x), his/her expected academic results would be bad (small h). Thus, the punishment would be more severe (higher p). The probability of punishment is represented by δ, which is chosen by the parent (the parent's optimization problem will be discussed below). $\delta p(h)$ is the expected value of the punishment. Intuitively, the expected value of the punishment increases with the probability of punishment δ but decreases with the expected human capital stock h and thus effort x. We assume $u_2 < 0$ and $u_{22} < 0$. The second term v is the adulthood utility depending on h, with $v' > 0$ and $v'' < 0$. Comparative static yields the following[6] (see Appendix A.1 for details):

$$\frac{dx^*}{d\delta} = \frac{-aru_2p'}{au_{11} + a\delta r\left(u_{22}\delta rp' + ru_2p''\right) + r^2v''} > 0. \tag{2}$$

The higher the probability of punishment, the more effort the child would exert for his/her human capital investment. For simplicity, the model assumes that the parent lives in the current period only. His/her utility function is given by[7]

$$\max_{\{\delta\}} U(m) + u(x, \delta p(h)) + v(h) - b\delta. \tag{3}$$

The parent generates utility from his/her consumption and his/her paternalistic concern toward the child. The first term is the parent's utility derived from his/her endowed resources (his/her consumption m). The second and third terms capture the parent's paternalistic concern. The only difference in the child's utility function given in (1) from the parent's paternalistic concern, that is, the second and third terms in (3), is parameter a in the first term of (1), which presents a heavier weight ($a > 1$) of the current utility in the child's utility function. This difference is the source of disagreement on the optimal amount of x between the parent and the child and thus provides the parent the incentive to discipline the child to exert more effort by choosing a positive value of δ. The last term is the utility cost of punishing the child, where b is a parameter that represents the parent's distaste for punishing the child. Comparative static yields the following (see Appendix A.2 for details)

$$\frac{d\delta^*}{dr} = \frac{-u_{22}p'x^* - \left(\delta u_2p' + v'\right)\frac{dx^*}{d\delta}}{u_{11}\frac{d^2x^*}{d\delta^2} + u_{22}p'r\frac{dx^*}{d\delta} + \delta r^2u_{22}p''\frac{d^2x^*}{d\delta^2} + ru_2p'\frac{dx^*}{d\delta} + r^2v''\frac{d^2x^*}{d\delta^2}} > 0. \tag{4}$$

Intuitively, the utility maximization of the parent implies that a higher productivity of the effort to raise human capital would increase the return of disciplining the child to exert more effort in his/her human capital investment. Thus, the incentive of the parent to choose a higher probability of punishment would increase. A child suffering from DDLD would have a lower r, which would reduce the parent's return in disciplining the child to exert more effort. As a result, the parent would choose a lower probability of punishment. We will formally test this hypothesis in Sections 3 and 4.

As discussed earlier, Doepke and Zilibotti (2017) predict that more educated parents are more likely to switch from an authoritarian to an authoritative style than less educated parents. The DZ model indirectly predicts a negative effect of the parent's education level on the likelihood of punishment because potential punishment is a clear demonstration of an authoritarian parenting style but not of an authoritative style. This insight can be embedded into our model. As mentioned earlier, the parent's paternalistic concern, which is represented by a heavier weight (a>1) of the current utility in the child's utility function than the parent's, leads to a disagreement on the optimal amount of x between the parent and the child. This condition provides the parent with the incentive to choose a positive value of δ. If a more educated parent has an advantage in molding his/her child's preference, as suggested in the DZ model, his/her child's weight on the current period in his utility function is more likely to be close to 1, that is, similar to that of the parent. Therefore, the child's choice of x would be close to the parent's desired level. As a result, the more educated parent would choose a lower δ, that is, he/she would be less likely to punish. Intuitively, a more educated parent can be more effective in motivating his/her child to work harder by molding his/her preferences. Therefore, his/her incentive to use potential punishment to discipline his/her child to work harder would be reduced.

3. Model specifications and data

The estimating equation for the likelihood of punishment can be written as follows:

$$U_i = \beta_0 + \beta_1 DDLD_i + \beta_2 E_i + X_i'\theta_i + \varepsilon_i, \tag{5}$$

where U_i is "unlikely punish". E_i is the number of years of schooling completed by the parent. X_i is a vector of relevant demographic characteristics. The main variable of interest is DDLD. Our hypothesis predicts that β_1 is positive, and the DZ model predicts a positive β_2.

A challenge to our estimation is the potential endogeneity of DDLD because of the omitted variable bias. In our illustrative theoretical model, the physical development of the children is taken as exogenous for simplicity. However, the likelihood of punishment and DDLD are potentially driven by the same unobserved common factors empirically or determined simultaneously in a static model. As mentioned earlier, DD can be caused by "genetic causes (like Down syndrome), or complications of pregnancy and birth (like prematurity or infections)" (Boyse, 2010). Meanwhile, "LD are due to genetic and/or neurobiological factors." (Learning Disabilities Association of America, n.d.). Therefore, DDLD is potentially subject to omitted genetic factors and unobserved heterogeneity in family and parental characteristics. Specifically, parents pass their genes to their children. If the genetic factors causing the children's DDLD are correlated with the parent's ability to regulate their emotions and thus the likelihood of punishment, the ordinary least squares (OLS) estimates of the effects of DDLD on the likelihood of punishment may be biased. Similarly, if the probability of having DDLD and the likelihood of punishment are driven by some unobserved heterogeneity in family and parental characteristics, this unobserved heterogeneity may bias the OLS estimates of the effects of DDLD on the likelihood of punishment.

To reduce the potential omitted variable bias, we estimate the equation with biological sibling fixed effects using the sample of biological

[5] The shape of the response of punishment to performance P(.) is taken as fixed, so that the representative parent only chooses the probability of punishment in his/her optimization problem. The details of the parent's optimization problem will be explained later.

[6] The asterisk (*) stands for optimal choice.

[7] Upper and lower-case variables refer to the parent and child, respectively.

Table 1
Summary statistics (Sample of biological children).

Variable	Number of Observations	Mean	Standard Deviation	Min	Max
Unlikely punish	1494	0.327	0.469	0	1
Punishment likelihood index (5: Not at all likely; 1: Very likely)	1494	2.655	1.537	1	5
DDLD	1504	0.080	0.271	0	1
MR	1504	0.009	0.096	0	1
Father	1517	0.063	0.242	0	1
Family income (USD)	1517	73,954.630	78,068.000	0	1,067,300
Black	1514	0.391	0.488	0	1
Hispanic	1514	0.081	0.272	0	1
Asian	1514	0.019	0.137	0	1
Parent's education level	1442	13.030	2.490	0	17
Girl	1517	0.484	0.500	0	1
Age of parent	1513	40.661	6.689	24	69
Age of child	1517	13.401	2.169	9	17
Send the child to room if the child becomes angry at PCG	1483	0.430	0.495	0	1
Take away allowance if the child becomes angry at PCG	1483	0.149	0.356	0	1
Take away TV, phone, or other privileges if the child becomes angry at PCG	1483	0.564	0.496	0	1

siblings. The summary statistics of the sample of biological siblings are presented in Appendix Table A1. By comparing the likelihood of punishment among biological siblings, this approach identifies the DDLD effect on the likelihood of punishment with genetic factors (from either father or mother at least) and all unobserved heterogeneity in family and parental characteristics being controlled for.

This study uses data from the 2007 CDS in PSID. PSID is a longitudinal study of a representative sample of individuals and families in the US. CDS Wave I was collected in 1997. It contains information on 2,394 families with 3,563 children. The dataset used in this section is from Wave III (CDS-III), which was collected in 2007 and 2008. 1,506 children aged 10-19 were interviewed in CDS-III. In the survey, the primary care givers (PCG) to children were interviewed. Our model focuses on the parent-child interaction. Thus, only observations of the biological children of the PCGs are used for our empirical study unless otherwise specified. We also drop the observations where the age gap between parent and child is smaller than 14 to avoid outliers. In the interview, the PCG (that is, the biological father or mother in our main sample) of each child was asked the following question:

If [CHILD] brought home a report card with grades or progress lower than expected, would you punish (CHILD)? Would you say that would be "not at all likely," "somewhat unlikely," "not sure how likely," "somewhat likely," or "very likely?"

We define a dummy variable "unlikely punish," which is equal to 1 if the parent's response to the preceding question is "not at all likely" or "somewhat unlikely." The dummy variable is equal to 0 if his/her response is "not sure how likely," "somewhat likely," or "very likely." The dataset also contains information on having developmental problems, such as DDLD of children. In the interview, the parent of each child was also asked the following question.

Has [CHILD's] doctor or health professional ever said that [CHILD] had developmental problems, such as developmental delay or learning disability?

In our analysis, we define the dummy variable "DDLD" equal to 1 if the parent's response to the question earlier is *Yes* and equal to 0 if the response is *No*. In our dataset, 8% of the children in our sample were diagnosed by a doctor or health professional as having DDLD. In 2005–2006, 0.7% and 5.6% of the children enrolled in US public schools, from prekindergarten through 12th grade, were served in federally supported programs for DD and specific LD, respectively (Snyder et al., 2008).[8] Therefore, the proportion of DDLD in our sample is reasonable. The parent's education level is measured by the number of years of schooling he/she completed. Other control variables include the parent's age, family income, race, and sex of the children. The summary statistics of the sample of biological children are presented in Table 1.

4. Results

4.1. OLS results

Table 2 presents the OLS results. Consistent with our punishing investment hypothesis, DDLD is positively associated with the probability of "unlikely punish." The estimated coefficients of DDLD are significant at the 5% level, and their magnitudes become larger when other control variables are included. [9] Column 3 shows that the probability of "unlikely punish" is 10.8 percentage points higher for the parents of children with DDLD if their children brought home a report card with grades or progress lower than expected. The coefficients of the parent's education level are also positive and significant in Columns 2 and 3. This finding indicates that the parent's education level is positively associated with the probability of "unlikely punish." It supports the DZ model. Column 3 shows that one more year of education completed by the parent increases the probability of "unlikely punish" by 1.2 percentage points. Column 4 presents the results when the interaction between DDLD and the parent's education level is included. DDLD and the interaction are jointly significant at 5% level. The estimated coefficients of DDLD and the interaction are positive and negative, respectively. The estimated coefficients indicate that DDLD is positively associated with "unlikely punish" in our sample range, i.e. parent's education level is between 0 and 17, but this positive association is falling with parent's education level.

The coefficients of fathers are negative in Columns 2 and 3 and insignificant. This result indicates weak evidence that the father being the PCG is negatively associated with "unlikely punish". The age of the parent is positively associated with the probability of "unlikely punish," and the coefficients of the age of the child are insignificant. Black and Hispanic are negatively associated with the probability of "unlikely pun-

[8] According to Learning Disabilities Association of America, LD covers a number of specific LD, such as dyslexia and dysgraphia (Learning Disabilities Association of America, n.d.).

[9] This outcome is probably because of a downward bias resulted by the omission of family background variables in Column 1. The effect of family background, such as family wealth, on unlikely punishment is positive, and family background and DDLD are negatively correlated. Thus, omitting family background variables would bias the DDLD coefficient downward.

Table 2
OLS estimates of the effects of developmental delay or learning disability on “unlikely punish” (sample of biological children).

Dependent Variable: “Unlikely Punish”	(1)	(2)	(3)	(4)
DDLD	0.069	0.101**	0.108**	0.435++
	(0.047)	(0.047)	(0.047)	(0.278)
Father		-0.067	-0.081	-0.082
		(0.052)	(0.052)	(0.051)
Log (family income)		0.049***	0.032**	0.032**
		(0.014)	(0.014)	(0.014)
Black		-0.185***	-0.181***	-0.182***
		(0.028)	(0.028)	(0.028)
Hispanic		-0.090*	-0.092*	-0.090*
		(0.048)	(0.048)	(0.048)
Asian		0.304***	0.265**	0.268**
		(0.109)	(0.113)	(0.113)
Parent’s education level		0.016***	0.012**	0.014**
		(0.006)	(0.006)	(0.006)
DDLD × Parent’s education level				-0.026++
				(0.022)
Girl		0.060**	0.065***	0.066***
		(0.024)	(0.024)	(0.024)
Age of parent			0.010***	0.010***
			(0.002)	(0.002)
Age of child			0.006	0.006
			(0.006)	(0.006)
Constant	0.321***	-0.376**	-0.616***	-0.634***
	(0.013)	(0.146)	(0.156)	(0.157)
Sample size	1494	1413	1410	1410
R^2	0.002	0.095	0.115	0.109

Notes: Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level. ++ DDLD and DDLD × Parent’s education level are jointly significant at 5% level.

ish,” but Asian are positively associated with it.[10] Girls are positively associated with the probability of “unlikely punish.”

One of the major concerns on the preceding results is the measurement of the likelihood of punishment. Regressions with different measurements of the likelihood of punishment are conducted to check the robustness of the results. If the results are robust, then the signs of the estimated coefficients of DDLD in these models should be consistent with our hypothesis. We construct an index of the likelihood of punishment. We label “not at all likely,” “somewhat unlikely,” “not sure how likely,” “somewhat likely,” and “very likely” from 5 to 1, respectively, and take these numbers as an index of the likelihood of punishment. Then, we estimate the models with this index as the dependent variable. Our model predicts that parents have a lower probability of punishing their child if the latter suffers from DDLD. Thus, the coefficient of DDLD is predicted to be positive. The results are presented in Table 3. As predicted by our hypothesis, the coefficients of DDLD are positive, and significant at the 5% level when other control variables are included. In Column 3, the index of the likelihood of punishment increases by 0.36 for a child with DDLD. Column 4 reports the results when DDLD and the parent’s education level interaction is included. The results are similar to those in Table 2. The positive association between DDLD and “unlikely punish” remains but it is falling in the parent’s education level. In summary, the positive association between DDLD and “unlikely punish” is robust to different measurements of the punishment likelihood. The coefficients of the parent’s education level are positive and significant.[11]

4.2. Sibling fixed effects results

Although these results are consistent with our hypothesis, potential endogeneity issues exist. Therefore, the sibling fixed effects method is used. Since the OLS results presented in Tables 2 and 3 are estimated with the sample of biological children, they are not directly comparable with the sibling fixed effects results, which are estimated with the sample of biological siblings. Thus, we report the OLS results estimated with the sample of biological siblings in Panel A of Table 4A. The estimated coefficients of DDLD are positive and statistically significant. Column 1 in Panel A shows that the probability of “unlikely punish” is 11.7 percentage points higher for a child with DDLD. In both specifications, the estimated coefficients of the parent’s education level are positive and significant. For both variables, their estimated coefficients’ magnitudes are slightly larger than their counterparts in Tables 2 and 3 (Column 3).

Panel B of Table 4A reports the results of the sibling fixed effects. Consistent with our hypothesis, the coefficients of DDLD are positive and are significant at the 5% level. These results provide evidence of a positive effect of DDLD on “unlikely punish” with genetic factors and unobserved heterogeneity in family and parental characteristics controlled. In Column 1, suffering from DDLD increases the probability of “unlikely punish” by 15.5 percentage points. Column 2 reports that the index of the likelihood of punishment increases by 0.42 if the child has DDLD. The magnitudes of the estimated coefficients of DDLD are larger in Panel B. This result suggests that the coefficients of DDLD are biased downward in Panel A due to the omitted variables.[12] The downward bias may be caused by the omitted genetic variables in the OLS estimations. Suppose that a high value of the omitted genetic variable indicates high genetic quality. If the parents with high genetic quality are less likely to punish their children, the effect of the genetic variable on “unlikely punish” would be positive. As the children of the parents with high genetic quality are less likely to have DDLD (that is, the genetic variable and

[10] The positive coefficient of Asian parents may be surprising because the book “Battle Hymn of the Tiger Mother” describes “tiger parenting” as a Chinese parenting style. In fact, although Chinese is the largest ethnic group within Asian Americans, it is far from dominant. Asian Americans are composed of different ethnic groups, and the four largest ethnic groups in 2010 are Chinese (22.8%), Asian Indian (19.4%), Filipino (17.4%), and Vietnamese (10.6%) (Jones, 2012).

[11] We also define a dummy variable “very unlikely punish,” which is equal to 1 if the parent’s response to the preceding question is “not at all likely” and 0 otherwise. The result of the regression with “very unlikely punish” as the dependent variable is reported in Appendix Table A3 Column 1.

[12] A similar result of the regression with “very unlikely punish” as the dependent variable is reported in Appendix Table A3 Columns 2a and 2b.

Table 3
OLS estimates of the effects of developmental delay or learning disability on "punishment likelihood index" (Sample of biological children).

	Dependent Variable: "Punishment Likelihood Index (5: Not at all likely; 1: Very likely)"			
	(1)	(2)	(3)	(4)
DDLD	0.237	0.333**	0.357**	1.347++
	(0.148)	(0.151)	(0.152)	(0.911)
Father		-0.216	-0.266	-0.266
		(0.166)	(0.165)	(0.164)
Log (family income)		0.156***	0.105**	0.105**
		(0.045)	(0.046)	(0.046)
Black		-0.757***	-0.740***	-0.743***
		(0.092)	(0.092)	(0.092)
Hispanic		-0.430***	-0.439***	-0.432***
		(0.160)	(0.161)	(0.160)
Asian		1.176***	1.045***	1.053***
		(0.295)	(0.298)	(0.299)
Parent's education level		0.059***	0.044**	0.050**
		(0.019)	(0.019)	(0.020)
DDLD × Parent's education level				-0.078++
				(0.069)
Girl		0.252***	0.269***	0.272***
		(0.077)	(0.077)	(0.077)
Age of parent			0.033***	0.033***
			(0.007)	(0.007)
Age of child			0.004	0.003
			(0.020)	(0.020)
Constant	2.636***	0.359	-0.290	-0.344
	(0.041)	(0.471)	(0.501)	(0.502)
Sample size	1494	1413	1410	1410
R^2	0.002	0.130	0.147	0.141

Notes: Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level. ++ DDLD and DDLD × Parent's education level are jointly significant at 5% level.

Table 4A
OLS and Fixed Effects Estimates of the Effects of Developmental Delay or Learning Disability on the Likelihood of Punishment (Sample of Biological Siblings)

	Panel A: OLS	
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
DDLD	0.117**	0.410**
	(0.057)	(0.182)
Parent's education level	0.017**	0.064**
	(0.008)	(0.025)
Sample size	983	983
R^2	0.130	0.163
	Panel B: Sibling Fixed Effects	
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
DDLD	0.155**	0.422**
	(0.065)	(0.194)
Sample size	983	983
R^2 (within)	0.013	0.015

Notes: A constant is contained in all specifications. In Panel A, other control variables include father, age of parent, age of child, log (family income), Black, Hispanic, Asian, and girl. In Panel B, other control variables include age of child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level.

DDLD are negatively correlated), the omission of the genetic variable in the OLS would bias the estimated effect of DDLD on "unlikely punish" downward.

One may argue that the DDLD effect may be different for students with different academic achievement. Thus, we also compare children below and above the mean in passage comprehension standardized score. Passage comprehension is a subtest in Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R), which "measures cognitive ability and academic achievement" (American Psychological Association, n.d.). The results are presented in Table 4B. The estimated coefficients of DDLD are all positive, but some of them become insignificant, probably because of much smaller sample size. Importantly, we do not observe clear pattern of difference in the DDLD effect across the children below and above the mean in passage comprehension standardized score.

Another interesting concern is that parents may treat children differently depending on their birth order (Hao et al, 2008). We thus test

Table 4B
OLS and Fixed Effects Estimates of the Effects of Developmental Delay or Learning Disability and Biological Parent on the Likelihood of Punishment by Child Reading Skills

	Panel A: Dependent Variable "Unlikely Punish"			
	OLS		Sibling Fixed Effects	
	Above mean	Below mean	Above mean	Below mean
	(1a)	(1b)	(2a)	(2b)
DDLD	0.165	0.114*	0.225*	0.107
	(0.119)	(0.064)	(0.133)	(0.088)
Parent's education level	0.013	0.013		
	(0.012)	(0.011)		
Sample size	497	486	497	486
R^2/ R^2 (within)	0.124	0.065	0.013	0.019
	Panel B: Dependent Variable "Punishment Likelihood Index (5: Not at all likely; 1: Very likely)"			
	OLS		Sibling Fixed Effects	
	Above mean	Below mean	Above mean	Below mean
	(3a)	(3b)	(4a)	(4b)
DDLD	0.501	0.445**	0.592	0.351
	(0.371)	(0.210)	(0.382)	(0.263)
Parent's education level	0.079**	0.039		
	(0.040)	(0.037)		
Sample size	497	486	497	486
R^2/ R^2 (within)	0.160	0.085	0.010	0.037

Notes: all 'a' specifications are estimated with the sample of passage comprehension standardized score above average and biological siblings. All 'b' specifications are estimated with the sample of passage comprehension standardized score below average and biological siblings. A constant is contained in all specifications. In specifications 1a, 1b, 3a, and 3b, other control variables include father, age of parent, age of child, log (family income), parent's education, Black, Hispanic, Asian, and girl. In specifications 2a, 2b, 4a and 4b other control variables include the age of the child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level."

whether a parent's likelihood to use punishment varies by birth order by estimating the regressions with birth order to mother and birth order to father being control variables.[13] The results are essentially the same and both birth order variables are found to be insignificant (Table A4 in appendix).[14]

5. Further robustness tests and alternative explanations

5.1. Alternative measures of development deficiency

Our hypothesis predicts that the likelihood of punishment should decrease in the severity of development deficiency. DDLD could be used as a general proxy of a disturbance in the productivity of a child's effort in human capital investment but does not categorize the severity of the disturbance of productivity. One way to investigate the empirical relationship between the likelihood of punishment and its severity is to include other chronic conditions that indicate a different level of severity in disturbing the productivity of the child's effort than DDLD. In our dataset, the parent was asked the following question:

Has [CHILD's] doctor or health professional ever said that [CHILD] had mental retardation?

According to the American Association on Intellectual and Developmental Disabilities, mental retardation (MR) is defined as "a disability characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills" that manifests before 18 years old (Slap, 2008). Compared with DDLD, the development deficiency of MR should be more severe. This difference offers room for identifying the empirical relationship between the likelihood of punishment and the severity of development deficiency. Specifically, our hypothesis predicts that DDLD and MR should have a positive effect on the "unlikely punish," while the positive effect of MR should be generally larger than that of DDLD. According to Hyman (2007), approximately 1% of the population suffers from MR, which is remarkably close to the corresponding figure in our sample (Table 1).

We define a dummy variable "MR," which is equal to 1 if the parent's response to the abovementioned question is *Yes* and 0 otherwise. Table 5 presents the estimated coefficients of MR and DDLD in different specifications. Panels A and B report the results of OLS (sample of siblings) and sibling fixed effects, respectively. Our hypothesis predicts that the coefficients of MR and DDLD should be positive. The results confirm our prediction. All estimated coefficients of MR are positive and significant. Compared with the OLS results reported in Panel A, the magnitude of the MR coefficient is larger in the fixed effects model in specification 1 but is smaller in specification 2. These results suggest that the magnitudes of the estimated coefficients of MR do not exhibit a clear pattern of omitted variable bias. However, similar to the results in reported in Table 4, the magnitudes of the coefficients of DDLD in both specifications are larger in Panel B. This result indicates that the OLS estimated DDLD coefficients are biased downward due to the omitted variables. Another prediction by our hypothesis is that the estimated effect of MR should be generally larger than DDLD. The results in Table 5 confirm this prediction as well. All specifications show that the magnitude of the estimated coefficients of MR are much larger than that of DDLD. For instance, Panel B Column 1 indicates that the probability of "unlikely punish" increases by 54.8% and 8.7% if the child has MR and DDLD, respectively. Similarly, the index of the likelihood of punishment increases by 1.39 and 0.25 if the child has MR and DDLD, correspondingly. Generally, the results presented in Table 5 provides reasonable support for our hypothesis. The coefficients of the parent's education level are positive and significant in all specifications in Panel A. These results support the DZ model. [15]

[13] Birth order to mother and father might be different because they may have children from other relationships.

[14] We also estimated the regressions by including the interaction between DDLD and birth order. The coefficients of the interaction term are insignificant.

[15] A similar result of the regression with "very unlikely punish" as the dependent variable is reported in Appendix Table A3 Columns 3a and 3b.

Table 5
OLS and fixed effects estimates of the effects of mental retardation and developmental delay or learning disability on the likelihood of punishment (Sample of biological siblings).

Panel A: OLS		
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
MR	0.506***	1.481***
	(0.129)	(0.408)
DDLD	0.059	0.240
	(0.058)	(0.188)
Parent's education level	0.017**	0.066***
	(0.008)	(0.025)
Sample size	983	983
R^2	0.140	0.170
Panel B: Sibling Fixed Effects		
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
MR	0.548***	1.392***
	(0.147)	(0.335)
DDLD	0.087	0.250
	(0.068)	(0.202)
Sample size	983	983
R^2 (within)	0.032	0.028

Notes: A constant is contained in all specifications. In Panels A, other control variables include father, age of parent, age of child, log (family income), Black, Hispanic, Asian, and girl. In Panel B, other control variables include age of child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level. #MR and DDLD are jointly significant at the 10% level.

Table 6
OLS and fixed effects estimates of the effects of developmental delay or learning disability and biological parent on "unlikely punish" (Full sample of siblings).

Panel A: OLS		
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
DDLD	0.693***	2.599***
	(0.156)	(0.446)
DDLD × BP	-0.577***	-2.192***
	(0.167)	(0.483)
Biological parent (BP)	0.222***	0.635**
	(0.075)	(0.271)
PCG's education level	0.019**	0.072***
	(0.007)	(0.024)
Sample size	1012	1012
R^2	0.140	0.175
Panel B: Sibling Fixed Effects		
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
DDLD	1.051***	2.210***
	(0.031)	(0.101)
DDLD × BP	-0.896***	-1.788***
	(0.071)	(0.200)
Sample size	1012	1012
R^2 (within)	0.019	0.018

Notes: A constant is contained in all specifications. In Panel A, other control variables include male PCG, age of PCG, age of child, log (family income), Black, Hispanic, Asian, and girl. In Panel B, other control variables include age of child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level.

5.2. Are parents more kind to children with development deficiency?

One may argue that parents would be sympathetic if their children were suffering from DDLD. In psychology literature, some studies find that the parents of children with DD are less likely to blame their children for their problematic behavior because these parents believe their children have less responsibility for it ("kind effect") (Whittingham et al., 2008; Jacobs et al., 2017). The "kind effect" implies a positive effect of DDLD on "unlikely punish." Therefore, one may argue that parents are unlikely to punish children living with DDLD not because of the low return of punishment on human capital ("human capital effect") but because of the "kind effect."

One way to test against the "kind effect" hypothesis is to re-estimate the regressions with the full sample of siblings (that is, the PCGs are not necessarily the children's biological parents) (see Appendix Table A2 for the summary statistics of the full sample of siblings) and to add an interaction term of a new dummy variable "biological parent" (BP) and DDLD to the empirical model. BP is equal to 1 if the PCG is the biological parent and equal to 0 otherwise. We can reasonably argue that the biological parents of children suffering from DDLD would likely exhibit a stronger "kind effect." If the DDLD effect presented earlier (estimated by the sample of biological children) is purely driven by the "kind effect," then the coefficient of the interaction term should be positive, and the positive coefficient of DDLD would become less positive and insignificant. The regression results are shown in Table 6. In both panels, the coefficients of DDLD are positive and significant at the 1% level. In contrast to the "kind effect" hypothesis, the coefficients of the interaction of DDLD and BP are negative and significant in Panel A, which means a lower probability of biological parents choosing "unlikely punish" if their children have DDLD. Similar results are reported in Panel B. This observation suggests that biological parents do not exhibit the "kind effect" if a child with DDLD brought home a report card with grades or progress lower than expected. Remarkably, these results indicate that the estimated positive DDLD effect on "unlikely punish" is improbably driven by a dominating "kind effect." Conversely, the negative and significant coefficients of the interaction of DDLD and BP may suggest that the "kind effect" is dominated by another effect, the "stress effect."

The parents of children with DD may become more frustrated because their children are more challenging. Some psychology studies find that the parents of children with DD experience more parenting stress (Chan and Neece, 2018). This higher level of stress can result in "intrusive parenting" (imposing the parent's view on the child) and reduce the parent's sensitivity to the child's needs ("stress effect") (Anthony et al., 2005; Crnic et al., 2005; Chan and Neece, 2018). The "kind effect" and the "stress effect" are potentially competing. The "kind effect" implies a positive effect of DDLD on "unlikely punish", whereas the "stress effect" possibly implies a negative one. The negative and significant coefficients of the interaction of DDLD and BP reported in Table 6 are possibly resulted by a dominating "stress effect" on biological parents.[16] [17]

Another method to test against the "kind effect" hypothesis is to estimate the effect of DDLD on some actions that are unlikely to be motivated by the purpose of human capital investment with the sample

[16] A similar result of the regression with "very unlikely punish" as the dependent variable is reported in Appendix Table A3 Columns 4a and 4b.

[17] One may argue that the negative coefficients of the interaction of DDLD and BP can be explained by "stronger love leads to tougher punishment." Comparing to non-biological parents, biological parents may have stronger love to their children, and thus has higher incentive to invest in their children's human capital with different methods, possibly including punishing their children. It implies that a potential negative BP effect on "unlikely punish." This "stronger love" hypothesis is not convincing. The estimated BP coefficients are positive (see Panel A of Table 6), contradicting to the prediction by "stronger love" hypothesis.

Table 7
OLS and fixed effects estimates of the effects of developmental delay or learning disability on the likelihood of alternative actions when the child became so angry at His/Her Parents (Sample of biological siblings).

Panel A: OLS			
	(1)	(2)	(3)
Dependent variable	Self-restraint on sending the child to room	Self-restraint on taking away allowance	Self-restraint on taking away privileges
DDLD	-0.077	-0.018	-0.104*
	(0.059)	(0.045)	(0.057)
Sample size	977	977	977
R^2 (within)	0.073	0.060	0.039
Panel B: Sibling Fixed Effects			
	(1)	(2)	(3)
Dependent variable	Self-restraint on sending the child to room	Self-restraint on taking away allowance	Self-restraint on taking away privileges
DDLD	-0.057	0.009	-0.071
	(0.075)	(0.059)	(0.067)
Sample size	977	977	977
R^2 (within)	0.038	0.002	0.015

Notes: A constant is contained in all specifications. In Panels A, other control variables include father, age of parent, age of child, log (family income), Black, Hispanic, Asian, parent's education, and girl. In Panel B, other control variables include age of child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level.

of biological siblings. The dataset contains the parent's answer to the following question:

Most children get so angry at their parents that they say things like "I hate you," swear in a temper tantrum, or hit you. If (CHILD) did any of these, what would you do?

1 SEND CHILD TO (HIS/HER) ROOM
2 TAKE AWAY (HIS/HER) ALLOWANCE
3 TAKE AWAY TV, PHONE, OR OTHER PRIVILEGES

We define a dummy variable "self-restraint on …" for each one of the parent's actions. The dummy is equal to 1 or 0 if the response to the corresponding action is *No* or *Yes* respectively. The actions listed in this question are in response to the relationship and interaction between the child and the parent. They are not in response to the child's human capital investment nor do they increase the child's labor market prospect directly. Thus, the actions are unlikely to be motivated by the purpose of human capital investment compared with receiving a report card with grades or progress lower than expected. In contrast, these actions are likely to reflect the kindness of the parent toward the child. Accordingly, we can test the "kind effect" hypothesis by regressing the dummy variables of these actions on DDLD.[18] The coefficients of DDLD in these regressions identify the effect of DDLD on the parental self-restraint on the response to the child's bad behavior, which is a combination of the "kind effect" and the "stress effect." If the "kind effect" dominates, we expect the coefficients of DDLD to be positive and significant. If not, we would fail to find any evidence of this "kind effect" dominating the "stress effect." [19] The OLS and sibling fixed effects results are shown in Table 7. The OLS coefficients of DDLD reported in Panel A are generally negative and statistically insignificant. These results suggest that the "stress effect" weakly dominates the "kind effect" when the children behave improperly. However, in the sibling fixed effects models (Panel B), the signs of the DDLD coefficients are mixed, and none of the coefficients are statistically significant. For example, the probability of "self-restraint on sending the child to room" decreases by 5.7% for a child with DDLD (Panel B Column 1). However, that of "self-restraint on taking away allowance" increases by 0.9% (Panel B Column 2). These results indicate that we do not find any strong evidence on either the "kind effect" or the "stress effect" dominating when the children behave improperly. Our findings provide further evidence that positive estimated coefficients of DDLD on "unlikely punish" is unlikely to be driven by a dominating "kind effect."

6. Conclusion

In this study, we develop a simple economic analysis on a common instrument of "tiger parents" in parenting, which is to punish their children, in the context of human capital investment. We attempt to look into the black box of an authoritarian parenting style mentioned in Doepkoe and Zilibotti (2017). Our study provides a more general explanation of punishment in a human capital investment framework that considers the parent's utility cost in punishing the child in generating the prediction that the parent would choose a lower probability to punish a child suffering from DDLD because of the lower return to the forced child's effort in human capital investment. We find strong evidence consistent with this prediction through the data from PSID. We also find generally supportive evidence on Doepkoe and Zilibotti's prediction on the role of parental education in parenting style.

On the controversy over "tiger parenting," the subject matters in the debate in the media and the public are often about its cultural, social and economic factors, and its effectiveness on enhancing children development. Our study identifies another important factor, yet neglected so far, behind "tiger parenting," that is, the children's capability. The strong evidence we found on the negative effect of DDLD on the likelihood of punishment indicates that the effects of children's attributes on their parents' parenting behavior need to be further explored. Our study also suggests a new research direction on the effect of child developmental deficiency on parenting. Are parents of the children with developmental deficiency more likely to use other parenting approaches, such as positive rewarding? How do different types of child development deficiency affect parenting? What is the mechanism of the parents of children with developmental deficiency in choosing among different parenting approaches? Further research is needed to answer these questions.

[18] Same as Tables 2 to 5, we estimate these models with the sample of biological parents.

[19] Similarly, the coefficients of the parent's education capture the effect of the parent's education on their kindness to the child and thus would not provide any direct or indirect evidence for testing DZ model's prediction.

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Appendix

A.1. Optimization of the child

$$\max_{\{x\}} \; au(x, \delta p(h)) + v(h).$$

Note that $h = rx + \varepsilon$. The first-order condition is

$$au_1 + au_2\delta rp' + rv' = 0.$$

The second-order condition is

$$au_{11} + a\delta r\left(u_{22}\delta rp' + ru_2p''\right) + r^2v'' < 0.$$

By differentiating the FOC with respect to δ and rearranging, we obtain

$$\frac{dx^*}{d\delta} = \frac{-aru_2p'}{au_{11} + a\delta r\left(u_{22}\delta rp' + ru_2p''\right) + r^2v''} > 0.$$

A.2. Optimization of the parent

$$\max_{\{\delta\}} U(m) + u(x, \delta p(h)) + v(h) - b\delta.$$

The first-order condition is

$$u_1\frac{dx^*}{d\delta} + u_2\mathrm{p}\left(rx^* + \varepsilon\right) + \delta \mathrm{u}_2\mathrm{rp}'\frac{dx^*}{d\delta} + zrv'\frac{dx^*}{d\delta} - b = 0.$$

The second-order condition is

$$u_{11}\frac{d^2x^*}{d\delta^2} + u_{22}p'r\frac{dx^*}{d\delta} + \delta r^2u_{22}p''\frac{d^2x^*}{d\delta^2} + ru_2p'\frac{dx^*}{d\delta} + r^2v''\frac{d^2x^*}{d\delta^2} < 0.$$

By differentiating the FOC with respect to r and rearranging, we obtain

$$\frac{d\delta^*}{dr} = \frac{-u_{22}p'x^* - \left(\delta u_2p' + v'\right)\frac{dx^*}{d\delta}}{u_{11}\frac{d^2x^*}{d\delta^2} + u_{22}p'r\frac{dx^*}{d\delta} + \delta r^2u_{22}p''\frac{d^2x^*}{d\delta^2} + ru_2p'\frac{dx^*}{d\delta} + r^2v''\frac{d^2x^*}{d\delta^2}} > 0.$$

Table A1
Summary statistics (Sample of biological siblings).

Variable	Number of Observations	Mean	Standard Deviation	Min	Max
Unlikely punish	1030	0.331	0.470	0	1
Punishment likelihood index (5: Not at all likely; 1: Very likely)	1030	2.648	1.553	1	5
DDLD	1037	0.079	0.270	0	1
MR	1037	0.010	0.098	0	1
Father	1045	0.042	0.201	0	1
Family income	1045	72,404.290	77,614.380	0	880,480
Black	1042	0.422	0.494	0	1
Hispanic	1042	0.067	0.250	0	1
Asian	1042	0.013	0.115	0	1
Parent's education level	1007	13.044	2.387	0	17
Girl	1045	0.491	0.500	0	1
Age of parent	1043	40.187	6.526	26	69
Age of child	1045	13.297	2.135	9	17
Send the child to room if the child becomes angry at PCG	1,024	0.438	0.496	0	1
Take away allowance if the child becomes angry at PCG	1,024	0.146	0.354	0	1
Take away TV, phone, or other privileges if the child becomes angry at PCG	1,024	0.556	0.497	0	1
Passage comprehension standardized score above average	1,045	0.500	0.500	0	1

Table A2
Summary statistics (Full sample of siblings).

Variable	Number of Observations	Mean	Standard Deviation	Min	Max
Unlikely punish	1062	0.329	0.469	0	1
Punishment likelihood index (5: Not at all likely; 1: Very likely)	1062	2.646	1.554	1	5
DDLD	1069	0.081	0.274	0	1
MR	1069	0.012	0.110	0	1
Father	1077	0.041	0.198	0	1
Family income	1312	72,258.980	76,374.280	0	880,480
Black	1,309	0.432	0.496	0	1
Hispanic	1,309	0.063	0.244	0	1
Asian	1309	0.015	0.120	0	1
Parent's education level	1036	13.004	2.387	0	17
Girl	1312	0.492	0.500	0	1
Age of parent	1073	40.516	7.112	23	78
Age of child	1312	13.546	2.213	9	17
Send the child to room if the child becomes angry at PCG	1054	0.436	0.496	0	1
Take away allowance if the child becomes angry at PCG	1054	0.151	0.358	0	1
Take away TV, phone, or other privileges if the child becomes angry at PCG	1054	0.556	0.497	0	1

Table A3
OLS and fixed effects estimates of the effects of developmental delay or learning disability and biological parent on "Very unlikely punish".

Dependent Variable: "Very Unlikely Punish"	(1) OLS	(2a) OLS	(2b) Sibling Fixed Effects	(3a) OLS	(3b) Sibling Fixed Effects	(4a) OLS	(4b) Sibling Fixed Effects
MR				0.356**	0.354**		
				(0.164)	(0.158)		
DDLD	0.057	0.046	0.094*	0.005	0.051	0.706***	1.030***
	(0.041)	(0.049)	(0.056)	(0.049)	(0.058)	(0.156)	(0.028)
DDLD × BP						-0.661***	-0.935***
						(0.164)	(0.059)
Biological parent (BP)						0.122 (0.075)	
Parent/PCG's education level	0.005 (0.005)	0.008 (0.007)		0.008 (0.007)		0.010 (0.007)	
Sample size	1410	983	983	983	983	1012	1012
R^2/ R^2 (within)	0.066	0.069	0.014	0.075	0.025	0.082	0.022

Notes: Specification 1 is estimated with the sample of biological children. Specifications 2a, 2b, 3a and 3b are estimated with the sample of biological siblings. Specifications 4a and 4b are estimated with the full sample of siblings. A constant is contained in all specifications. In specifications 1, 2a, 3a, and 4a, other control variables include father, age of parent/PCG, age of child, log (family income), Black, Hispanic, Asian, and girl. In specifications 2b, 3b and 4b, other control variables include the age of the child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level.

Table A4
OLS and fixed effects estimates of the effects of developmental delay or learning disability on the likelihood of punishment (sample of biological siblings): Including child birth order.

Panel A: OLS	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
DDLD	0.132*	0.466**
	(0.075)	(0.226)
Parent's education level	0.022**	0.084***
	(0.009)	(0.028)
Birth order to mother	-0.010	-0.073
	(0.025)	(0.082)
Birth order to father	0.017	0.089
	(0.022)	(0.071)
Sample size	742	742
R^2	0.115	0.143
Panel B: Sibling Fixed Effects		
	(1)	(2)
Dependent variable	Unlikely Punish	Punishment Likelihood Index (5: Not at all likely; 1: Very likely)
DDLD	0.203**	0.594**
	(0.097)	(0.271)
Birth order to mother	0.011	-0.030
	(0.050)	(0.133)
Birth order to father	0.020	0.100
	(0.050)	(0.133)
Sample size	742	742
R^2/ R2 (within)	0.021	0.029

Notes: A constant is contained in all specifications. In Panel A, other control variables include father, age of parent, age of child, log (family income), Black, Hispanic, Asian, and girl. In Panel B, other control variables include age of child and girl. Robust standard errors are in parentheses. ***significant at the 1% level, **significant at the 5% level, and *significant at the 10% level.

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