PARENTING PRACTICES AND CHILDREN'S COGNITIVE EFFORT: A LABORATORY STUDY

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Abstract

We examine the association between parenting practices (discipline and support) and children's cognitive effort. Cognitive effort is hard to measure; hence, little is known in general about effort dispositions, and in particular about the influence of parenting practices on effort. We present data from a study on almost 1,400 fifth grade students from Berlin and Madrid. Cognitive effort is measured with tests of executive function. The students do the tests under an unincentivised and incentivised condition. We study two effort-related outcomes: "effort direction" – the child's decision to voluntarily do a real-effort task – and "effort intensity" – the child's performance on the task. Results indicate that both parental discipline and support are associated with effort direction and the presence of incentives moderates this association. However, only parental discipline is (weakly) associated with effort intensity. We conclude that parenting practices primarily influence deliberative rather than instinctual types of cognitive effort.

Keywords: parenting; effort; incentives; cognition

1 Introduction

Cognitive effort, the mobilisation of cognitive resources to achieve a particular goal, is typically regarded as "aversive" (Kurzban et al., 2013; Westbrook & Braver, 2015) – i.e. something individuals wish to minimise. Recent work in neuroscience has shown that individuals can be "trained" to exert more effort by offering material incentives for

effortful activity (Brown et al. 2022; Clay et al. 2022; Lin, Westbrook, and Inzlicht 2022). The "training" leads to a spillover effect, where individuals who come to associate effort with reward subsequently display greater effort even in non-remunerated tasks. Thus, variations in effort may represent the internalised association between effort and reward. But little is known about what aspects of an individual's social environment regulate the susceptibility of effort to rewards.

In this paper, we examine the effect of parenting practices on children's cognitive effort. Extant research has demonstrated that parents exert a huge influence in the development of their children's personality (Demo, Small, and Savin-Williams 1987; Liu and Lachman 2019; Smith and Skrbiš 2017). Individual differences in effort disposition have been shown to partially reflect differences in upbringing, including responsiveness to intrinsic versus extrinsic rewards (Ginsburg & Bronstein, 1993). However, while previous research has reported significant associations between parenting and effort-related personality scales such as locus of control, conscientiousness or self-efficacy (Aguiar et al., 2021; Conger et al., 2021; Lamborn et al., 1991), there is a lack of studies using behavioural measures collected under laboratory conditions.

We focus on the role of parental discipline and parental support – arguably the two most consequential dimensions of parenting practice (Liu & Lachman, 2019; Locke & Prinz, 2002) – on children's effort under different incentive structures. We argue that discipline orients children towards external rewards and hence boosts extrinsic motivation, whereas support develops a child's self-esteem and hence boosts intrinsic motivation. In order to test our hypotheses, we present the first large-scale study on

the relationship between parenting practices, extrinsic incentives, and cognitive effort as measured by executive function. The data come from an experiment featuring almost 1,400 children from Germany and Spain. Novel to the parenting literature is the joint inclusion of (i) varying material incentives; and (ii) measuring effort using executive function. We contribute to the literature, which is dominated by survey studies, by examining a behavioural measure of effort under varying incentives.

Conceptually, we distinguish between "effort direction": voluntary participation in a task; and "effort intensity": how much effort is invested in the task. Results indicate that the implications of parenting depend on the kind of effort. Parental support is associated with effort direction though the introduction of material incentives weakens the association. Support is not associated with intensity of effort, regardless of incentive. On the other hand, parental discipline is weakly associated with higher effort intensity across incentives. Its association with effort direction is conditional on the presence of incentives.

2 Effort and motivation

Broadly speaking, effort is conceived of as the mobilisation of cognitive resources in order to achieve a particular goal. In cognitive psychology and neuroscience, cognitive effort is usually identified with the engagement of "executive function", or conscious and non-automatic cognitive activity (Baumeister et al., 1998; Kurzban et al., 2013). Engaging executive function is costly because human brains have limited bandwidth. Effort is therefore theorised to feel "aversive" as the body's way of signalling that important cognitive functions are being engaged which could be deployed otherwise (Kurzban et al., 2013; Shenhav et al., 2017).

Since engaging executive function is costly, a utilitarian perspective implies that when an individual exerts cognitive effort on a task they must be deriving greater benefits from the exertion of effort than the cost of effort (Inzlicht et al., 2018; Kurzban et al., 2013; Westbrook & Braver, 2015). The benefit of effort can be further decomposed into extrinsic benefit – instrumental or material rewards such as money – and intrinsic benefit – the inherent value an individual derives from performing the task (Shenhav et al., 2017). It is a reasonable assumption that individuals who are more extrinsically (intrinsically) motivated to perform a task will derive more extrinsic (intrinsic) benefit from doing the task (Bonner & Sprinkle, 2002; Cameron & Pierce, 1994). Intuitively, one might assume that the effects of intrinsic and extrinsic motivation are independent of each other. But it has been repeatedly found that material incentives actually dampen the effect of intrinsic motivation and even *reduce* total effort (Bonner & Sprinkle, 2002; Cerasoli et al., 2014; Deci et al., 1999) – a phenomenon termed "crowding out."

3 Types of effort

The decision to exert cognitive effort on a given task can be broken down into two distinct aspects: direction and intensity. Direction refers to whether or not to engage with a task in the first place; intensity refers to how much effort to invest in the task, given that one is engaged with it. Though terminologies differ somewhat, the direction/intensity distinction is recognised in the literature (Bonner & Sprinkle, 2002; Shenhav et al., 2017).

Effort direction is essentially concerned with preferences: whether the individual is willing to invest themselves in an activity which will place demands on their executive

function. Cognitive science represents this as a deliberative process in which an individual "samples" values from the true utility value distribution of alternatives (Rangel & Hare, 2010). Intensity, on the other hand, is concerned more with performance: how much an individual is willing or disposed to exert themselves, moment-to-moment, in the engagement of their executive function (Bijleveld, 2018; Westbrook & Braver, 2015). This means that individuals who exert themselves more intensively must constantly overcome the "aversive" feeling of exerting effort (Kurzban et al., 2013; Shenhav et al., 2017). In essence, the direction versus intensity distinction closely resembles the distinction in the psychological literature concerning fast versus slow, or "System 1" versus "System 2" cognitive processes (Kahneman, 2011; Neys, 2022). Fast thinking is intuitive and instinctual – like the cognitive processes typically involved with effort intensity. Slow thinking is deliberative and reflective – like the cognitive processes typically involved with effort direction.

3 Parenting styles and motivation

Research on parenting styles has long distinguished *discipline* and *support* as two of the key dimensions of how parents mould childhood behaviour (Locke & Prinz, 2002). The terminology used to describe both of these core concepts can vary. Synonymous terms for the pair include, but are not limited to, "demandingness" and "responsiveness" (Baumrind, 1991), "discipline" and "affection" (Liu & Lachman, 2019), "discipline" and "nurturance" (Locke & Prinz, 2002), "warmth" and "control" (Maccoby & Martin, 1983), and "authority" and "nurturance" (Buri, 1989).

Generally speaking, both parental support and discipline tend to have positive effects on child achievement (Lamborn et al., 1991; López Turley et al., 2010) and

advantageous personality traits (Aguiar et al., 2021; Conger et al., 2021). Studies of parenting and cognitive effort, or executive function, are much rarer – and here the results are mixed (Liu & Lachman, 2019; Meuwissen & Carlson, 2015). There is some evidence for a positive association with discipline, though not with support.

Parents who emphasise discipline tend to adopt a directive style of communication, and to appraise the *output* of a child's behaviour according to fixed and external standards (Baumrind, 1991; Lamborn et al., 1991; Lareau, 2011; Pinquart, 2016). As in principal-agent models of economic behaviour (Frey & Jegen, 2001), the parent (principal) adjusts the cost of deviance and the benefit of compliance in order to regulate the child's behaviour. Discipline therefore enhances responsiveness to extrinsic motivation by orienting children towards instrumental and external incentives (Baumrind, 1991; Lamborn et al., 1991; Ryan & Deci, 2020). Overall then, parental discipline should be associated with greater effort among children, as associating effort with extrinsic incentives boosts the general disposition to exert effort (Brown et al. 2022; Clay et al. 2022; Lin, Westbrook, and Inzlicht 2022).

Hypothesis 1. Higher parental discipline is associated with greater effort.

And since parental discipline works by attuning children to extrinsic incentives:

Hypothesis 2 The association between parental discipline and effort is greatest when there are material incentives to perform well.

Parents who emphasise a supportive approach to childhood development tend to adopt a relational style of communication, aiming to elicit the child's feelings and thoughts to encourage their autonomous development (Baumrind, 1971; Lareau, 2011). Emphasis is placed on the *input* to the child's decisions. Parents who adopt a

supportive approach aim to build the child's self-esteem by encouraging them to identify and autonomously develop their talents and interests (Buri, 1989; Demo et al., 1987; Sears, 1970; Turner et al., 2009). Greater self-esteem is associated with greater self-efficacy, which tends to be associated with greater performance (Lamborn et al., 1991; Ryan & Deci, 2020). Hence:

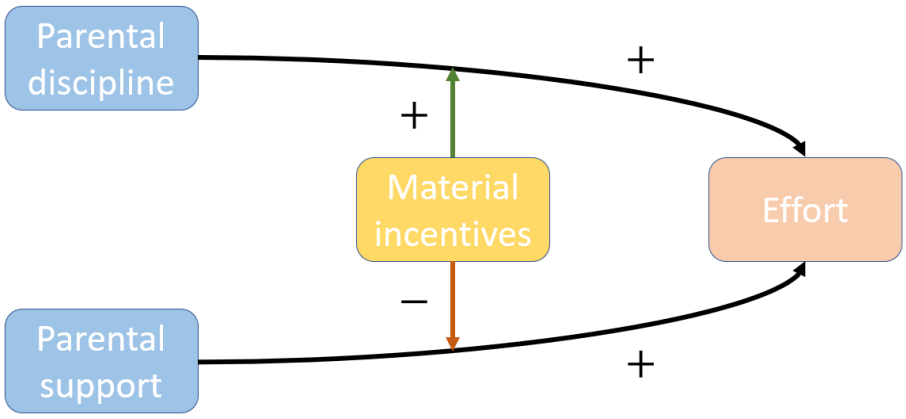
Hypothesis 3 Higher parental support is associated with greater effort.

Parental support boosts self-esteem and autonomy (Buri, 1989; Ryan & Solky, 1996; Sears, 1970), which are associated with greater intrinsic motivation (Ryan & Deci, 2020; Turner et al., 2009). However, intrinsic motivation is typically "crowded out" by external rewards (Bénabou & Tirole, 2006; Deci, 1975; Frey & Jegen, 2001). Hence:

Hypothesis 4 The association between parental support and effort is greatest when there are no material incentives to perform well.

The conceptual relationship between parental support, discipline, material incentives and effort is graphed in Figure 1. While we have discussed support and discipline as distinct dimensions, the influential work of Baumrind has theorised that discipline and support positively interact (Baumrind, 1991). Empirical work has supported this supposition for mental health and certain non-cognitive skills (Fletcher & Jefferies, 1999; Padilla-Walker et al., 2013; Spera, 2006). But it has not been firmly established whether Baumrind's framework translates from its original context - childhood and adolescent emotional development – to more performance-related contexts (Nyarko, 2011; Pinquart, 2016; Weiss & Schwarz, 1996), such as cognitive effort domains.

FIGURE 1. CONCEPTUAL MODEL OF PARENTING PRACTICES, INCENTIVES, AND EFFORT



4 Data and Methods

Data

We analyse data from a novel experiment featuring the participation of 1,368 fifth-grade students from schools in Madrid and Berlin, carried out between 2019 and 2022. In principle, every child in each participating school class took part in the experiments. The dataset has several advantages. Firstly, it has a much larger sample size than most laboratory experiments. Secondly, the schools were randomly selected from a sample that was stratified by neighbourhood income quartile and type of school (public versus private), such that the sample approximates the general population of fifth graders in the two cities. Thirdly, the data implement multiple types of real-effort task to ameliorate bias due to specific abilities as in single-task studies. Fourthly, the data allows for measurement of both effort direction and intensity, which is rare in most datasets. And fifthly, the children did the task under both an unincentivised and an incentivised condition, a combination rarely if ever achieved using large samples.

Real-effort Tasks

The participants completed three different types of real-effort task, all designed to engage executive function. Executive function comprise different subdomains (Anderson, 2002; Miyake et al., 2000), including: (i) information processing and updating ; (ii) regulation and control; and (iii) cognitive flexibility and switching between different activities.

Each of the three tasks tests a subdomain of executive function. The slider task (Gill & Prowse, 2019) primarily covers the information processing and updating subdomain. In the slider task, the participants are presented with 48 horizontal lines. There is a dial on each line and the participant must adjust the dial so it is exactly at the midpoint. The Simon task (Cespón et al., 2016) tests the regulation and control subdomain. In the Simon task, participants had to tap a certain button on the keyboard when a left-pointing arrow appeared on screen and a different button when a right-pointing arrow appeared on screen. The arrows could appear left, centre or right. The third task was the "AX-Continuous Performance Task" (Hefer & Dreisbach, 2016), which tests cognitive flexibility. In this task, participants had to press a certain combination of buttons in response to a string of numbers.

Experimental Design

The order of the tasks varied across experimental sessions. The students did the experiment under two different conditions: an unincentivised condition, in which there was no reward for performance in the tasks; and a material incentive condition, in which the students were rewarded with toys for performance in the task.

The participants received basic instructions at the start of the experiment. They then did a practice round of the first task, followed by a practice round of two games: a

jigsaw puzzle and a ball-bouncing game. The participant then did two rounds of the first task under the unincentivised condition, and two rounds in the incentivised condition. Then came the second task, with two rounds under the unincentivised condition and two rounds under the incentivised condition. Finally they did the third task, with two rounds under the incentivised condition. (There was also a subsequent two rounds under a "tournament" condition, which we omit here). In each of the eight total rounds they had the choice to do either the puzzle game or ball game instead. Following the real effort tasks, the students completed a survey and an IQ test.

The design of the experiment allows us to measure both effort direction and intensity. The direction component is operationalised as a dichotomous variable which takes a value of 1 if the participant did the task and 0 if they did the game. The intensity component is operationalised as the number of correct answers, standardised *within-task*. The children decided to do the task in the vast majority (> 98%) of rounds in the material incentive and tournament conditions. Non-tasking was largely confined to the unincentivised condition, where it was the preferred option on circa 54% of rounds.

Variables

Our main independent variables are parental discipline and support. In the case of discipline, the children were asked to rank their mother and father on four levels from "*Not strict*" to "*Very strict*". In the case of support, the children were asked to rank their parent on four levels, ranging from "*She/he doesn't support me much*" to "*She/he supports me a lot*". For each question, participants also had the option to answer "*don't know*" or to refuse to answer – both of which were coded as missing. The data on both parents was combined into a single variable for both discipline and support,

taking the average value of discipline and support across parents. Where data was unavailable on one of the parents, the variable was given the value of the data on the available parent. We also mean-centre these variables to make them easier to interpret. As discussed in the theory section, Baumrind's influential work emphasizes the interaction between discipline and support. In Appendix A1 we present results indicating that there is no statistically significant interaction between parental support and discipline in our data. Appendix A3 provides the pairwise correlation between support and discipline and some behavioural correlates.

At the individual level, we adjust for standardised cognitive ability, using an adapted version of the Raven matrices measure of fluid intelligence (Baumeister et al., 1998), frequency of mouse use and videogaming to adjust for familiarity with computer interfaces, real effort task (Slider, Simon, or AX), gender, parental education, age in months, number of older and younger siblings, Spanish/German language usage at home, enjoyment of the task, and enjoyment of the ball and puzzle games. We also include a dummy for city (0 = Madrid, 1 = Berlin). We adjust for incentive condition – unincentivised (no material reward), or incentivised (material reward), while excluding the two tournament rounds from the analytic sample. In some models, incentive condition is interacted with the parenting dimensions.

The covariates are included to increase precision and to guard against confounding. Adjusting for fluid intelligence is particularly important. Effort is defined as engagement of executive function, but executive function capacity varies across individuals, meaning that we risk confounding engagement with capacity (Malanchini et al., 2019). Since fluid intelligence is highly correlated with executive function (Aken

et al., 2016), controlling for fluid intelligence should minimise the worry about confounding and increase precision.

We are wary about adjusting for covariates such as personality characteristics, though traits such as need for cognition are generally considered predictors of cognitive effort (Apascaritei et al., 2021; Westbrook & Braver, 2015). Parents exert a huge influence on a child's psychological composition. Hence, adjusting for psychological traits can lead to overcontrol bias (Grätz, 2022). In practice, these psychological variables do not seem to mediate the association between parenting styles and effort – as the results in Appendix A1 indicate. Finally, we do not have any solid theoretical or empirical rationale to suppose that the covariates we do include in the regression should induce "collider" or endogenous selection bias (Elwert & Winship, 2014). Nonetheless, it is impossible to establish that the independent variables of interest are exogenous conditioning on the observable variables we include in our regression models. In section 5.3 we implement a formal test to assess robustness to omitted variable bias.

Table 1 gives the descriptive statistics for each variable with a meaningful numeric interpretation that is used in the analyses. Descriptive statistics for a given variable pertain to all non-missing values for that variable in the dataset, including the tournament rounds that are excluded from the analytic sample. There are 13,680 observations in the total dataset (1,368 children X 10 rounds).

Table 1. *Descriptive statistics*

Variable	**Valid obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Task chosen instead of game?	13433	.88	.33	0	1
Correct, standardised by task	11365	0	1	-4.29	2.65
Parental discipline - mean centred	11810	.03	.77	-.9	2.1
Parental support - mean centred	12320	.03	.58	-2.6	.4

Parental tertiary education (0/1	11600	.53	.5	0	1
Male	13170	.48	.5	0	1
Age in months	13330	127.86	6.91	99	201
Fluid intelligence, standardised	13190	0	1	-5.15	3.56
Mouse use	13380	1.2	1.15	0	3
Daily computer use - videogames	13350	2.11	1.2	0	4
Number of older siblings	13290	.88	1.26	0	24
Number of younger siblings	13280	.71	.86	0	8
Child liked the task	11964	4.27	.93	1	5
I liked the game Ball-E	13390	3.43	1.33	1	5
I liked the puzzle	13390	3.53	1.25	1	5
Speak Spanish/German at home	13390	.96	.19	0	1
Berlin	13680	.41	.49	0	1

Note: Valid obs. refers to the non-missing observations for that variable. The maximum N = 13,680.

Statistical model

Each participant did up to eight rounds of real effort tasks (depending on how often they chose to game instead), meaning that within-participant observations are not independent. Participants are also nested in classrooms, meaning that there is within-classroom dependence. To account for the nested structure we run analyses using multilevel models of the general form:

$$y_{ijk} = \beta_0 + \beta_1 Discipline_{jk} + \beta_2 Support_{jk} + \beta_3 Extrinsic_{ijk} + XB + \gamma_k + \mu_j + \varepsilon_{ijk} (1)$$

Where i indexes the observation, j indexes the participant, and k indexes the classroom. The dependent variable, y_{ij}, is the measure of effort (dichotomous or continuous, depending on the model). $Discipline$ is the parental discipline variable, and $Support$ is the parental support variable. $Extrinsic$ is a dummy variable, taking a value of 1 if the observation belongs to the incentivised condition. XB is a vector of covariates and their coefficients, γ_k is a random intercept at the class level, μ_j is a random intercept fitted to each participant, and ε_{ij} is the idiosyncratic error term.

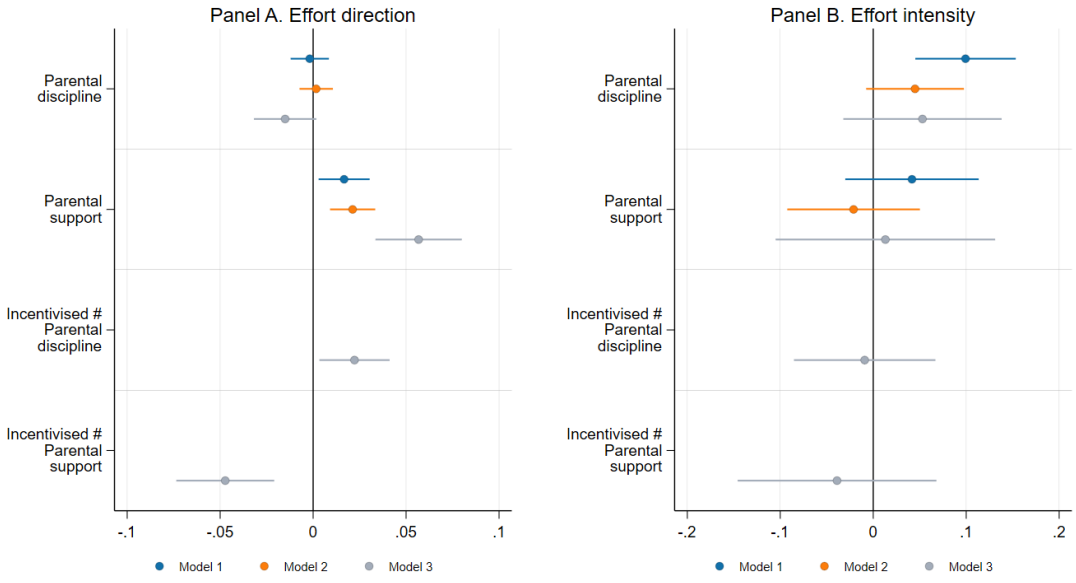
Equation 1 is modified slightly depending on the precise analysis, for example by interacting $Extrinsic$ with the parenting dimensions.

5 Results

5.1 Effort direction

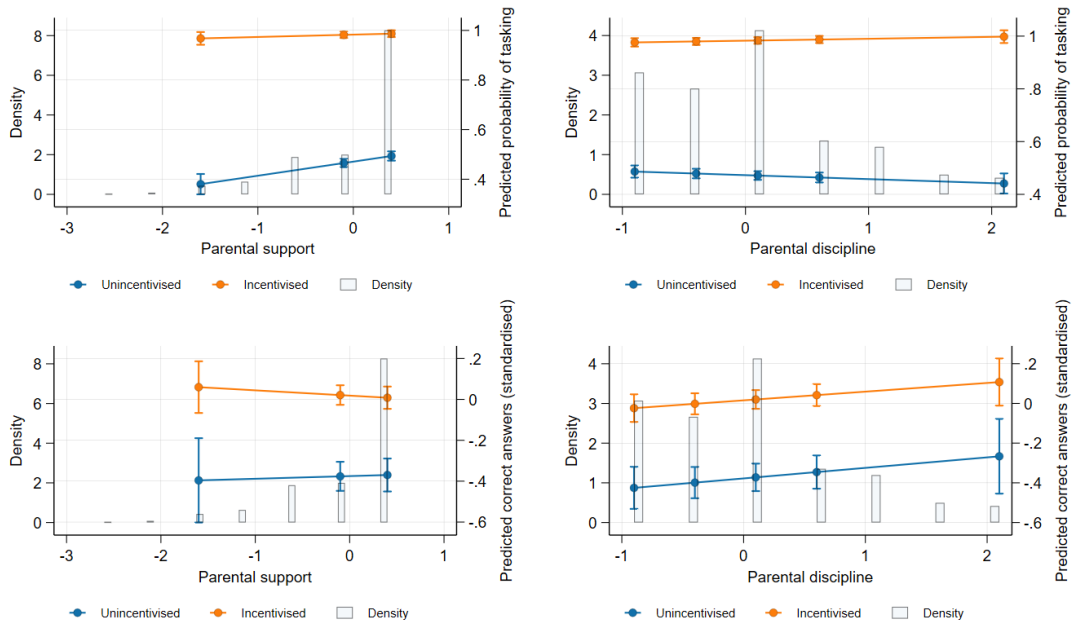
We begin our analysis with the effect of parenting practices on the direction of cognitive effort – i.e. the decision about whether or not to do the task. Three different specifications based on the general model (equation 1 above) were estimated. In each case the dependent variable, y_{ijk}, was the decision in round i of child j in school k to do the task or not. The key parameter estimates from the model are given in Table 2, and in Panel A of Figure 2. The marginal effects for the interaction are graphed in Figure 3. The full parameter estimates, along with alternative models including additional control vectors, are given in Appendix A1.

Figure 2. Association between parenting practices and effort



Model 1: no controls. Model 2: controls. Model 3: controls + interaction.
Control variables (parental education, gender, age, fluid intelligence, mouse use, video game play, number of older and younger siblings, Spanish/German language usage at home, task enjoyment, enjoyment of ball and puzzle games, task, and city) and constant omitted.
'Main effect' of incentivised condition also omitted to avoid stretching the x-axis in Panel A too much.

Figure 3. Marginal effects of parenting practices on decision to task and on correct answers



Marginal effects are derived from Model 3.
Predicted values are given for 1st, 25th, 50th, 75th, and 99th percentile. For parental support, the latter three percentiles have the same value.

Model 1 regresses effort direction on parental support and discipline without including any "control" variables. Model 2 includes the vector of control variables. Across both models, the coefficient on parental discipline is statistically insignificant and close to zero. On the other hand, the estimate for parental support is positive and statistically significant, and of roughly comparable magnitude across both models.

Model 3 interacts the parenting dimensions with the incentive condition (a dummy which takes a value of 1 if the task pertained to the incentivised condition). In this model, we see that parenting support has a positive and substantive association with effort direction in the unincentivised condition. A one-point increase in parental support (on a four-point scale), increases the probability of tasking by about 5% *when there are no material incentives*. On the other hand, as can be seen in the top left graph of Figure 3, there is a negative interaction between support and material incentives which flattens out the slope of the support-effort relationship. So, the

positive association between support and effort direction is greatest in the unincentivised condition, as was hypothesized above.

Contrariwise, Model 3 shows a *positive* and statistically significant interaction between parental discipline and material incentives, as was theoretically expected. The top right graph in Figure 3 shows that the slope of the association runs in contrasting directions. A one-point increase in parental discipline (on a four-point scale), increases the probability of tasking by about 2%, when there are material incentives. This effect roughly cancels out the negative association between discipline and effort direction in the unincentivised condition. Appendix A2 gives the results by city for a variety of models. The estimates are largely consistent within the city subsamples, albeit not always significant in Berlin (where the sample is smallest).

Table 2. *Regression of effort direction (decision to task)*

	Model 1	Model 2	Model 3
Parental discipline	0.000	0.002	-0.015
	(0.005)	(0.005)	(0.009)
Parental support	0.014*	0.021***	0.057***
	(0.007)	(0.006)	(0.012)
Incentivised (ref. cat = Unincentivised)		0.511***	0.510***
		(0.008)	(0.008)
Incentivised * Parental discipline			0.022*
			(0.010)
Incentivised * Parental support			-0.047***
			(0.013)
Constant	0.849***	0.358***	0.360***
	(0.006)	(0.080)	(0.080)
Controls	No	Yes	Yes
Class-level std dev	0.034***	0.036***	0.036***
	(0.005)	(0.005)	(0.005)
Participant-level std dev	0.000***	0.020***	0.021***
	(0.000)	(0.013)	(0.012)
Observation-level std dev	0.356***	0.269***	0.268***

	(0.003)	(0.003)	(0.002)
N	9166	6588	6588

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

5.2 Effort intensity

We now turn to the effect of parenting practices on effort intensity - the number of correct answers per round, standardised within-task. Rounds where the child did not do the task are excluded. As with the analysis of direction, three different models are estimated, with the key coefficients given in Table 3, and in Panel B of Figure 2, using as the dependent variable y_{ijk} the number of correct answers (standardised within-task) in round i, for participant j in class k. The full model estimates are given, alongside additional models, in Appendix A1.

Model 1 – the model without any control variables – show a generally positive association between discipline and effort intensity, and a null association for support.

Table 3. *Regression of effort intensity (correct answer, standardised)*

	Model 1	**Model 2**	**Model 3**
Parental discipline	0.099***	0.045	0.053
	(0.028)	(0.027)	(0.043)
Parental support	0.042	-0.021	0.013
	(0.037)	(0.036)	(0.060)
Incentivised (ref. cat = Unincentivised)		0.392***	0.394***
		(0.030)	(0.030)
Incentivised * Parental discipline			-0.009
			(0.039)
Incentivised * Parental support			-0.039
			(0.055)
Constant	-0.070	-2.307***	-2.311***

	(0.037)	(0.466)	(0.466)
Controls	No	Yes	Yes
Class-level std dev	0.226***	0.085***	0.085***
	(0.031)	(0.035)	(0.035)
Participant-level std dev	0.577***	0.502***	0.502***
	(0.017)	(0.017)	(0.017)
Observation-level std dev	0.753***	0.731***	0.731***
	(0.007)	(0.008)	(0.008)
N	6670	5463	5463

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

The introduction of the vector of controls in Model 2 portrays a somewhat different picture– discipline retains its positive direction but loses its statistical significance at the 0.05 level, while support takes on a negative trend – though it is not quite significant at the 0.05 level. Appendix A1 indicates that the estimate is statistically significant when an additional vector of psychological control variables is included, suggesting a weak, or at least imprecisely estimated, effect of discipline.

Model 3 interacts parenting with incentivised condition and here we see – in contradiction to the theoretical expectations – no evidence for an interaction between incentives and parental discipline. The bottom right graph in Figure 3 indicates no substantial difference in the steepness of the slope on parental discipline across the incentivised and unincentivised conditions. The coefficient on support in Model 3 remains insignificant at the 5 percent level. The results by city are given in Appendix A2. The association between discipline (uninteracted) and effort only holds up for the Madrid subsample.

5.3 Robustness of results

While we condition on a vector of control variable, the coefficients are nonetheless likely to be affected by omitted variable bias. Rather than remain entirely agnostic, we implement Oster's method for assessing robustness to omitted variable bias (Oster, 2019). Building on the work of (Altonji et al., 2005), Oster provides a method for approximating the parameter estimate on our independent variable of interest, adjusting for omitted variable bias caused by not controlling for unobserved confounders. The basic idea revolves around two quantities, δ and R_{max}. δ represents how much the omitted variables are correlated with the independent variable relative to observed confounders. R_{max} represents the r-squared if the unobserved variables were included. The analysis then precedes by investigating how much our estimate of the "true" coefficient, β^*, would change as δ and R_{max} are increased towards a theoretical upper bound. Obviously the actual upper bound cannot be known. Oster (2019) suggests that 1 is a plausible upper bound for δ. Meanwhile, let $R_{max} = \Pi\tilde{R}$, where $\tilde{R}$ is the r-squared in the regression with all controls included. Oster suggests a bounding value of $\Pi = 1.3$. We also consider the less conservative bound of $\Pi = \tilde{R}/\dot{R}$, where $\dot{R}$ is the r-squared from the uncontrolled regression.

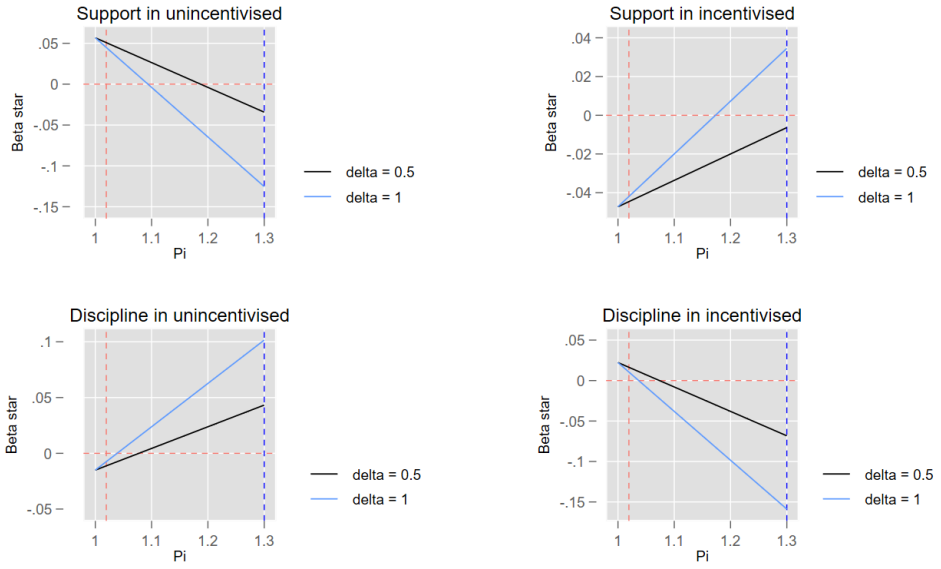
The formula for β^*, the theoretical unbiased coefficient, as a function of δ and R_{max} is:

$$\beta^* \approx \tilde{\beta} - \delta[\dot{\beta} - \tilde{\beta}]\frac{R_{max} - \tilde{R}}{\tilde{R} - \dot{R}}$$

Here the tilde superscript indicates a parameter from the adjusted regression (with controls) and the dot superscript represents a parameter from the unadjusted regression. Logically, the greater is $\dot{\beta} - \tilde{\beta}$, the difference between the adjusted and unadjusted coefficients is, the more "quickly" β^* reaches zero as a function of δ and

R_{max}. We use this formula to study the robustness of the estimates from Model 3 in effort direction and intensity – the full model that includes the interactions between incentive condition and parental support/discipline. We are interested in four coefficients per effort type: the "main effects" of support and discipline (i.e. the estimated correlation in the unincentivised condition, when the incentive dummy is zero), and the interaction terms between support/discipline and incentives. In some cases, the coefficient in the adjusted model, $\tilde{\beta}$, is greater than the unadjusted model, $\dot{\beta}$. Hence, we conservatively assume that further adjustments shrink β^*, and we replace $\dot{\beta} - \tilde{\beta}$ with its absolute value. In Appendix A4 we describe the logic of the method, and the details of our implementation, in greater detail.

Figure 4. Coefficient stability for effort direction

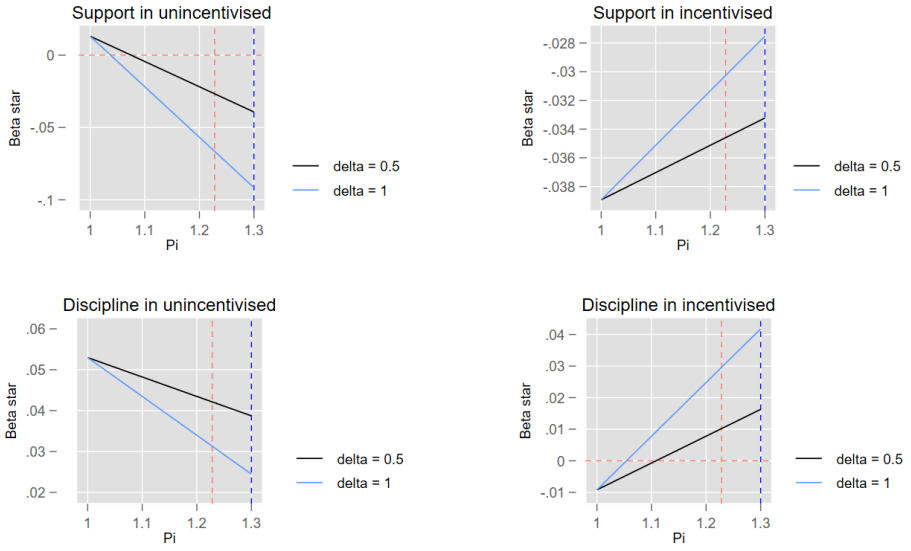


Dashed vertical red line gives ratio of r-squared in model with and without observed covariates.
Dashed vertical blue line gives the value of 1.3 times the r-squared in model with observed covariates.

Figures 4 and 5 graph the relationship between β^* and Π for effort direction and intensity respectively. The relationship is graphed for two values of δ, $\delta = 0.5$ (black line) and $\delta = 1$ (blue line). The vertical dashed blue line marks the value $\Pi = 1.3$. The dashed vertical red line gives the value $\Pi = \tilde{R}/\dot{R}$. We do not have space here to

discuss each parameter (that is done in greater detail in Appendix A4). But generally speaking, the analysis indicates that the statistically significant results presented above are fairly robust to omitted variable bias. For example, the coefficient on the interaction between parental support and incentives in effort direction (top right graph in Figure 4) does not reach zero by the upper bound of $\Pi = 1.3$ for the case where $\delta = 0.5$. Where $\delta = 1$, the parameter reaches zero before $\Pi = 1.3$, but well after $\Pi = \tilde{R}/\dot{R}$. And this is conservatively assuming that further adjustments shrink β^*, when in fact the adjusted parameter $\tilde{\beta}$ is greater in magnitude than unadjusted parameter $\dot{\beta}$, for this interaction.

Figure 5. Coefficient stability for effort intensity



Dashed vertical red line gives ratio of r-squared in model with and without observed covariates.
Dashed vertical blue line gives the value of 1.3 times the r-squared in model with observed covariates.

6 Discussion and conclusions

In this paper we examined the association of parental discipline and support with cognitive effort in a balanced sample of fifth graders in Spain and Germany. Drawing

on neuroscientific accounts we distinguished between two types of effort – direction and intensity. The former, we argued, concerns more reflective or deliberative cognitive processes, and the latter more reactive and instinctual ones. Following the literature on parenting styles and motivation we argued that parental discipline should be associated with greater effort (Hypothesis 1), especially when material incentives were present (Hypothesis 2). We theorised that parental support should also be associated with greater effort (Hypothesis 3), especially when material incentives were absent (Hypothesis 4)

These theoretical expectations were supported mainly in the case of effort direction. There was no general correlation between parental discipline and effort direction (no support for Hypothesis 1); but there was a general and robust correlation between support and effort direction (support for Hypothesis 3).

The interaction between discipline and incentives was statistically significant and positive (support for Hypothesis 2). Going from the least to the most disciplinary parents decreased a child's probability of tasking by about 5% absent incentives, but the effect was erased in the incentivised condition. On the other hand, as theoretically expected, the interaction between support and incentives was negative (support for Hypothesis 4). Going from the least to the most supportive parents increased a child's probability of tasking by about 10%, absent incentives. Further analysis indicates that these results are likely fairly robust to omitted variable bias (see section 5.3 and Appendix A4).

For effort intensity, parental discipline was positively correlated with effort intensity, though the association was only significant (at the 0.05) level in some models (see

Appendix A1 for more results). The effect size was small: going from the least to the most disciplinary parent increased effort by about 1/10 of standard deviation. Hence we have at best partial support for Hypothesis 1. There was no significant interaction between discipline and incentives (no support for Hypothesis 2). Parental support was not correlated with effort intensity, either generally or when interacted with material incentives (no support for Hypotheses 3 or 4).

Substantively, we conclude that our theoretical account best fits the case of effort direction. Parenting practices seem to influence the deliberative process involved in weighing the cost and benefits of exerting effort. In line with theory, discipline is associated with children giving more weight to material incentives in their deliberation, whereas support is associated with children giving more weight to intrinsic motivation.

However, our theoretical model is not consistent with the effort intensity results. The failure of the theory to accord with the findings we present here may reflect a lacuna in the literature. Most studies which examine the relationship between parental discipline and support and psychological constructs related to effort tend to rely on parent or children's self-reported outcomes. Such is the case for studies which investigate locus of control (Aguiar et al., 2021; Rodriguez, 2003), conscientiousness (Basirion et al., 2014; Conger et al., 2021; Weiss & Schwarz, 1996), and self-efficacy (Theresya et al., 2018; Turner et al., 2009). The way such outcomes are conceptualised tends to be much closer to the dimension of effort direction than effort intensity. Moreover, these constructs are measured using survey reports – i.e. asking the respondent to reflect on and assess their own (or their children's or students') level of

conscientiousness, self-efficacy and so on. This is a deliberative rather than instinctive account that cannot readily capture processes of cognitive fatigue or biases that arise in "fast thinking" situations that test the limits of individual willpower. Investigations of the association between parenting practices and behavioural correlates or measures of effort – such as executive function – are much rarer, and tend to find no positive association with parental support (Liu & Lachman, 2019; Meuwissen & Carlson, 2015).

The inconsistent results in the small literature on behavioural measures, alongside the results we present in this study, suggest that current models of parenting practices which have been validated on self-reported outcomes do not well explain effort intensity. There is a need to develop new theory to explain the influence of parenting on effort intensity and account for the everyday challenges to people's self-control.

In order to better understand the results presented here, we also made use of a smaller intergenerational (sub)sample of 230 parent-child dyads, where the parent of a child participant also did the real-effort tasks under the incentivised condition. We investigated whether more supportive and more disciplinary parents were better able to transmit their own effort propensity but found no significant association. The results reported in Appendix A5 show no evidence of such a mechanism.

One of the major limitations of this study is that our dependent variables are not exogeneous – hence we cannot provide (strong) causal interpretations to observed parenting "treatments". We have offered a formal test of the robustness of the measured association, both by conditioning on observables and assessing the potential degree of confounding on unobservables using Oster's method (Oster, 2019). Nonetheless, even without unobserved heterogeneity, we would not be able to guard

against reverse causality or endogeneity. Indeed, itt has been established that behavioural traits of children also influence parenting practices (Patterson & Fisher, 2002), though the effects tend to be somewhat weak (Eisenberg et al., 2005; Lengua & Kovacs, 2005; Meunier et al., 2011; Moilanen et al., 2015).

The gold standard to identifying causality is experimentally varying parenting practices. There is a literature which randomly assigns parental training, but the training tends to encompass a "package" of measures, which include both disciplinary and supportive approaches to parenting (Dishion et al., 2002; Eddy & Chamberlain, 2000; Martinez & Forgatch, 2001). Moreover, such studies also remain limited to intent-to-treat estimates and examined outcomes are typically dysfunctional behaviour or mental health rather than effort or related constructs, making findings hard to compare.

Another approach is the "sibling study" which allow the researcher to control for unobserved family-level heterogeneities, yielding a more plausible causal interpretation than standard observational approaches (albeit without variation in incentive structure). This literature has shown that parents consequentially influence traits such as conscientiousness, perseverance and focus, and locus of control (Anger & Schnitzlein, 2017; Grönqvist et al., 2017; Mazumder, 2008). Though none of these outcomes are exactly cognitive effort, they are close cousins. Hence, the evidence from sibling designs lends theoretical plausibility to the parenting-effort correlations that are reported in this study.

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Parenting Appendix

Appendix A1 Full regressions

Table A1.1 and Table A1.2 present results for several regressions of effort direction and intensity respectively. In each table, models 1 through 3 present the full results, including the control variables, for models 1 through 3 in the main text. Models 4 and 5 replicate Model 2 and Model 3 respectively, including a battery of psychological variables. And Model 6 includes the interaction between parental discipline and support theorised by the Baumrind typology (Baumrind 1991). The coefficients for the parenting practices and their interactions are plotted in Figure A1.1.

Table A1.1. *Regression of effort direction (decision to task)*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Parental discipline	0.000	0.002	-0.015	0.001	-0.019*	0.002
	(0.005)	(0.005)	(0.009)	(0.005)	(0.009)	(0.005)
Parental support	0.014*	0.021***	0.057***	0.021**	0.056***	0.021***
	(0.007)	(0.006)	(0.012)	(0.006)	(0.012)	(0.006)
Parental discipline * Parental support						-0.001
						(0.007)
Incentivised (ref. cat = Unincentivised)		0.511***	0.511***	0.510***	0.510***	0.511***
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Incentivised * Parental discipline			0.022*		0.027**	
			(0.010)		(0.010)	
Incentivised * Parental support			-0.047***		-0.047***	
			(0.013)		(0.014)	
AX task (ref. cat. = Slider)		0.003	0.003	0.001	0.001	0.003
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Simon task (ref. cat. = Slider)		0.013	0.013	0.013	0.013	0.013
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Parent university		0.008	0.008	0.008	0.008	0.008
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Male		-0.033***	-0.033***	-0.034***	-0.034***	-0.033***
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Age in months		0.001	0.001	0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fluid intelligence (stdsd)		-0.004	-0.004	-0.004	-0.004	-0.004
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Mouse use		-0.005	-0.005	-0.005	-0.005	-0.005
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Daily computer use - video games		0.001	0.001	0.002	0.002	0.001
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Number of older siblings		-0.000	-0.000	-0.000	-0.000	-0.000

		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Number of younger siblings		0.007	0.007	0.006	0.006	0.007
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Speak Spanish/German at home		0.058**	0.058**	0.051*	0.051*	0.058**
		(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Enjoyed ball game		-0.006*	-0.006	-0.006*	-0.006*	-0.006*
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Enjoyed task		0.012**	0.011**	0.011**	0.011**	0.012**
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Enjoyed puzzle game		-0.017***	-0.017***	-0.017***	-0.017***	-0.017***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Berlin		0.001	0.001	0.006	0.006	0.001
		(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Conscientiousness				0.002	0.002	
				(0.004)	(0.004)	
Need for cognition				0.010*	0.010*	
				(0.004)	(0.004)	
Delay of gratification				0.000	0.000	
				(0.004)	(0.004)	
Locus of control				-0.003	-0.003	
				(0.004)	(0.004)	
Constant	0.849***	0.357***	0.359***	0.372***	0.374***	0.357***
	(0.006)	(0.080)	(0.080)	(0.081)	(0.081)	(0.080)
Class-level std dev	0.034***	0.036***	0.036***	0.036***	0.036***	0.036***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Participant-level std dev	0.000***	0.020***	0.021***	0.020***	0.021***	0.020***
	(0.000)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
Observation-level std dev	0.356***	0.269***	0.268***	0.269***	0.268***	0.269***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
N	9166	6588	6588	6428	6428	6588

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

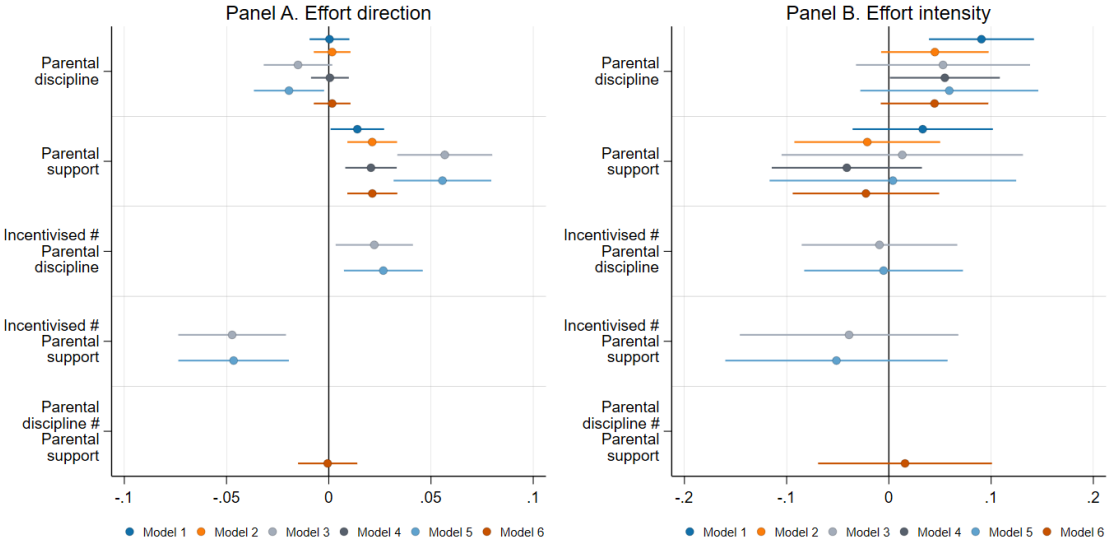
Table A1.2. *Regression of effort intensity (correct answers, standardised by task)*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Parental discipline	0.091***	0.045	0.053	0.055*	0.059	0.045
	(0.026)	(0.027)	(0.043)	(0.027)	(0.044)	(0.027)
Parental support	0.033	-0.021	0.013	-0.041	0.004	-0.022
	(0.035)	(0.036)	(0.060)	(0.037)	(0.062)	(0.037)
Incentivised (ref. cat = Unincentivised)		0.392***	0.394***	0.395***	0.398***	0.392***
		(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
AX task (ref. cat. = Slider)		-0.088***	-0.088***	-0.095***	-0.096***	-0.088***
		(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Simon task (ref. cat. = Slider)		-0.177***	-0.178***	-0.187***	-0.188***	-0.177***
		(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Parent university		0.230***	0.230***	0.230***	0.230***	0.230***
		(0.045)	(0.045)	(0.046)	(0.046)	(0.045)
Male		0.360***	0.360***	0.349***	0.349***	0.360***
		(0.045)	(0.045)	(0.046)	(0.046)	(0.045)
Age in months		0.008*	0.008*	0.007*	0.007*	0.008*
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Fluid intelligence (stdsd)		0.218***	0.218***	0.213***	0.213***	0.218***
		(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Mouse use		0.085***	0.085***	0.085***	0.085***	0.084***
		(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Daily computer use - video games		0.007	0.007	0.011	0.010	0.007
		(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Number of older siblings		-0.015	-0.015	-0.016	-0.016	-0.015
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Number of younger siblings		-0.071**	-0.071**	-0.075**	-0.075**	-0.071**
		(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Speak Spanish/German at home		0.131	0.131	0.098	0.098	0.128
		(0.124)	(0.124)	(0.127)	(0.127)	(0.125)
Enjoyed ball game		-0.018	-0.018	-0.022	-0.022	-0.018
		(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Enjoyed task		0.143***	0.143***	0.136***	0.135***	0.143***
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Enjoyed puzzle game		-0.031	-0.031	-0.026	-0.026	-0.031
		(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Berlin		0.119*	0.119*	0.200***	0.200***	0.120*
		(0.052)	(0.052)	(0.054)	(0.054)	(0.052)
Incentivised * Parental discipline			-0.009		-0.005	
			(0.039)		(0.040)	
Incentivised * Parental support			-0.039		-0.051	
			(0.055)		(0.055)	
Conscientiousness				-0.016	-0.016	
				(0.023)	(0.023)	
Need for cognition				0.068**	0.068**	
				(0.024)	(0.024)	

Delay of gratification				-0.031	-0.031	
				(0.022)	(0.022)	
Locus of control				0.005	0.005	
				(0.023)	(0.023)	
Parental discipline * Parental support						0.016
						(0.043)
Constant	-0.111**	-2.307***	-2.311***	-2.165***	-2.171***	-2.301***
	(0.038)	(0.466)	(0.466)	(0.469)	(0.469)	(0.466)
Class-level std dev	0.255***	0.085***	0.085***	0.072***	0.072***	0.085***
	(0.031)	(0.035)	(0.035)	(0.039)	(0.039)	(0.035)
Participant-level std dev	0.583***	0.502***	0.502***	0.500***	0.500***	0.502***
	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Observation-level std dev	0.757***	0.731***	0.731***	0.728***	0.728***	0.731***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
N	7552	5463	5463	5333	5333	5463

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

Figure A1.1 Association parenting practices and effort

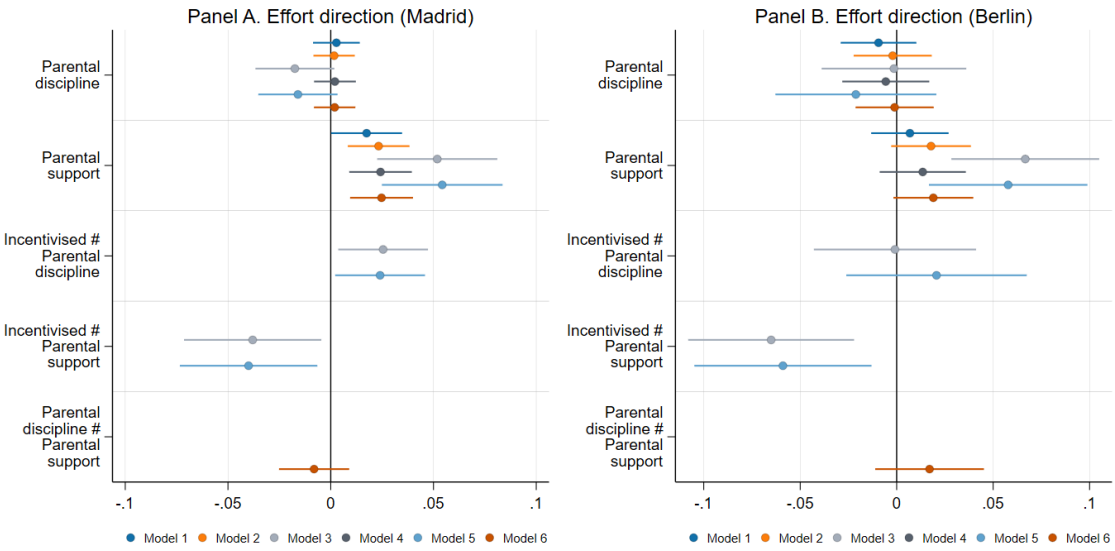


Model 1: no controls. Model 2: controls. Model 3: controls + support*incentive + discipline*incentive.
Model 4: controls + pysch. variables. Model 5: controls + pysch. variables + support*incentive + discipline*incentive.
Model 6: controls + pysch. variables + support*discipline.
Control variables (parental education, gender, age, fluid intelligence, mouse use, video game play, number of older and younger siblings, Spanish/German language usage at home, task enjoyment, enjoyment of ball and puzzle games, task, and city) and constant omitted.
Coefficient on 'Main effect' of incentivised condition also omitted to avoid stretching the x-axis in Panel A too much.

Appendix A2 Full regressions by city

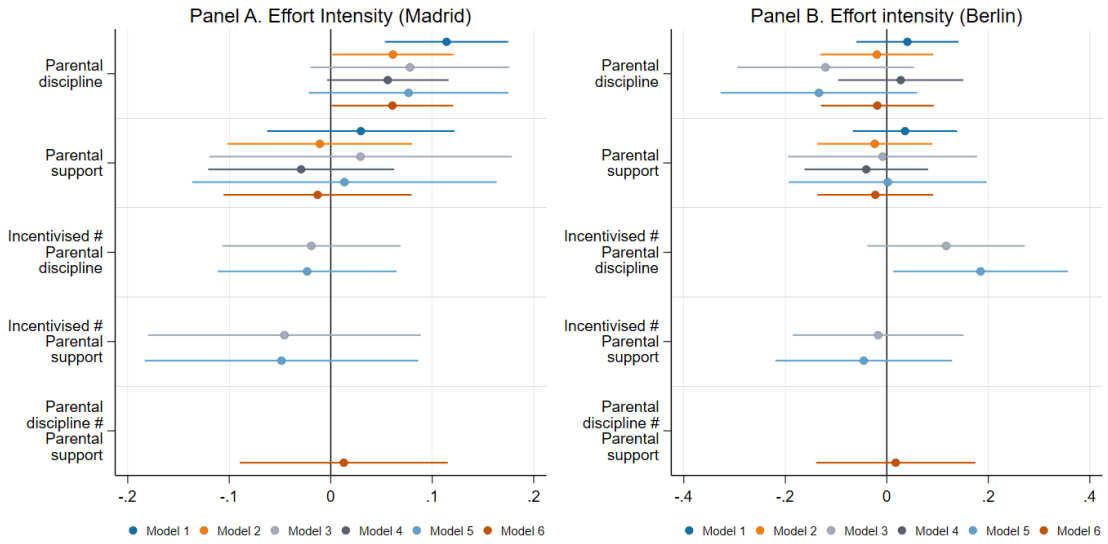
Tables A2.1 through A2.4 present the same models as in Appendix A1 (minus the city dummy) for the Berlin and Madrid subsamples. Figures A2.1 and A2.2 graphs the coefficients for effort direction for Madrid (Panel A) and Berlin (Panel B), for direction and intensity respectively.

Figure A2.1 Association between parenting practices and effort direction by city



Model 1: no controls. Model 2: controls. Model 3: controls + support*incentive + discipline*incentive.
Model 4: controls + pysch. variables. Model 5: controls + pysch. variables + support*incentive + discipline*incentive.
Model 6: controls + pysch. variables + support*discipline.
Control variables (parental education, gender, age, fluid intelligence, mouse use, video game play, number of older and younger siblings, Spanish/German language usage at home, task enjoyment, enjoyment of ball and puzzle games, task, and city) and constant omitted.
Coefficient on 'Main effect' of incentivised condition also omitted to avoid stretching the x-axis in Panel A too much.

Figure A2.2 Association between parenting practices and effort intensity by city



Model 1: no controls. Model 2: controls. Model 3: controls + support*incentive + discipline*incentive.
Model 4: controls + pysch. variables. Model 5: controls + pysch. variables + support*incentive + discipline*incentive.
Model 6: controls + pysch. variables + support*discipline.
Control variables (parental education, gender, age, fluid intelligence, mouse use, video game play, number of older and younger siblings, Spanish/German language usage at home, task enjoyment, enjoyment of ball and puzzle games, task, and city) and constant omitted.
Coefficient on 'Main effect' of incentivised condition also omitted to avoid stretching the x-axis in Panel A too much.

Table A2.1. *Regression of effort direction (decision to task) - Madrid*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Parental discipline	0.003	0.002	-0.017	0.002	-0.016	0.002
	(0.006)	(0.005)	(0.010)	(0.005)	(0.010)	(0.005)
Parental support	0.017*	0.023**	0.052***	0.024**	0.054***	0.025**
	(0.009)	(0.008)	(0.015)	(0.008)	(0.015)	(0.008)
Incentivised (ref. cat = Unincentivised)		0.518***	0.515***	0.520***	0.516***	0.518***
		(0.009)	(0.010)	(0.009)	(0.010)	(0.009)
AX task (ref. cat. = Slider)		0.002	0.002	0.001	0.002	0.002
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Simon task (ref. cat. = Slider)		0.009	0.009	0.009	0.009	0.009
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Parent university		0.007	0.007	0.008	0.008	0.007
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Male		-0.030**	-0.030**	-0.032***	-0.032***	-0.030**
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Age in months		0.000	0.000	0.000	0.000	0.000
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fluid intelligence (stdsd)		-0.003	-0.003	-0.003	-0.003	-0.003
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Mouse use		-0.004	-0.004	-0.004	-0.004	-0.004
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Daily computer use - video games		0.004	0.004	0.004	0.004	0.004
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Number of older siblings		-0.001	-0.001	-0.001	-0.001	-0.001
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Number of younger siblings		0.007	0.007	0.007	0.007	0.007
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Speak Spanish/German at home		0.097**	0.098**	0.096**	0.096**	0.098**
		(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Enjoyed ball game		-0.009*	-0.009*	-0.009*	-0.009*	-0.009*
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Enjoyed task		0.016**	0.015**	0.015**	0.015**	0.016**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Enjoyed puzzle game		-0.017***	-0.017***	-0.018***	-0.018***	-0.017***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Incentivised * Parental discipline			0.025*		0.024*	
			(0.011)		(0.011)	
Incentivised * Parental support			-0.038*		-0.040*	
			(0.017)		(0.017)	
Conscientiousness				0.003	0.003	
				(0.005)	(0.005)	
Need for cognition				0.005	0.005	
				(0.005)	(0.005)	
Delay of gratification				-0.003	-0.003	
				(0.004)	(0.004)	

Locus of control				-0.005	-0.005	
				(0.005)	(0.005)	
Parental discipline * Parental support						-0.008
						(0.009)
Constant	0.850***	0.343***	0.347***	0.347***	0.351***	0.341***
	(0.008)	(0.102)	(0.102)	(0.103)	(0.103)	(0.102)
Class-level std dev	0.041***	0.045***	0.045***	0.046***	0.046***	0.046***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Participant-level std dev	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observation-level std dev	0.354***	0.267***	0.267***	0.267***	0.267***	0.267***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
N	5710	4340	4340	4324	4324	4340

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

Table A2.2. *Regression of effort direction (decision to task) - Berlin*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Parental discipline	-0.009	-0.002	-0.001	-0.006	-0.021	-0.001
	(0.010)	(0.010)	(0.019)	(0.012)	(0.021)	(0.010)
Parental support	0.007	0.018	0.067***	0.014	0.058**	0.019
	(0.010)	(0.011)	(0.020)	(0.011)	(0.021)	(0.011)
Incentivised (ref. cat = Unincentivised)		0.496***	0.496***	0.489***	0.494***	0.496***
		(0.013)	(0.014)	(0.014)	(0.015)	(0.013)
AX task (ref. cat. = Slider)		0.004	0.004	0.001	0.001	0.005
		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Simon task (ref. cat. = Slider)		0.026	0.025	0.028	0.027	0.026
		(0.014)	(0.014)	(0.015)	(0.015)	(0.014)
Parent university		0.011	0.011	0.007	0.007	0.009
		(0.013)	(0.013)	(0.014)	(0.014)	(0.014)
Male		-0.040**	-0.040**	-0.042**	-0.042**	-0.042**
		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Age in months		0.002	0.002	0.002	0.002	0.002
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fluid intelligence (stdsd)		-0.006	-0.006	-0.009	-0.009	-0.007
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Mouse use		-0.007	-0.007	-0.008	-0.008	-0.008
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Daily computer use - video games		-0.004	-0.004	-0.001	-0.001	-0.003
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Number of older siblings		0.003	0.003	0.004	0.004	0.004
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Number of younger siblings		0.003	0.003	0.002	0.002	0.003
		(0.007)	(0.007)	(0.008)	(0.008)	(0.007)
Speak Spanish/German at home		0.033	0.033	0.020	0.020	0.028
		(0.029)	(0.029)	(0.030)	(0.030)	(0.029)

Enjoyed ball game		-0.001	-0.001	-0.004	-0.004	-0.002
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Enjoyed task		0.004	0.004	0.002	0.002	0.004
		(0.006)	(0.006)	(0.007)	(0.007)	(0.006)
Enjoyed puzzle game		-0.014**	-0.014**	-0.011*	-0.011*	-0.014**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Incentivised * Parental discipline			-0.001		0.021	
			(0.021)		(0.024)	
Incentivised * Parental support			-0.065**		-0.059*	
			(0.022)		(0.023)	
Conscientiousness				-0.001	-0.001	
				(0.008)	(0.008)	
Need for cognition				0.018*	0.018*	
				(0.007)	(0.007)	
Delay of gratification				0.009	0.009	
				(0.008)	(0.008)	
Locus of control				0.001	0.001	
				(0.007)	(0.007)	
Parental discipline * Parental support						0.017
						(0.014)
Constant	0.846***	0.264	0.265	0.293*	0.290*	0.266
	(0.007)	(0.142)	(0.142)	(0.146)	(0.146)	(0.142)
Class-level std dev	0.016***	0.000	0.000	0.000***	0.000	0.000
	(0.011)	(0.000)	(0.000)	(0.000)	(.)	(0.000)
Participant-level std dev	0.000***	0.038***	0.039***	0.037***	0.038***	0.038***
	(0.000)	(0.012)	(0.012)	(0.013)	(0.013)	(0.012)
Observation-level std dev	0.359***	0.271***	0.270***	0.270***	0.270***	0.271***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
N	3456	2248	2248	2104	2104	2248

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

Table A2.3**.** *Regression of effort intensity (correct answers, standardised by task) - Madrid*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Parental discipline	0.114***	0.061*	0.078	0.056	0.077	0.061*
	(0.031)	(0.031)	(0.050)	(0.031)	(0.050)	(0.031)
Parental support	0.030	-0.011	0.029	-0.029	0.013	-0.013
	(0.047)	(0.046)	(0.076)	(0.047)	(0.077)	(0.047)
Incentivised (ref. cat = Unincentivised)		0.343***	0.349***	0.345***	0.352***	0.343***
		(0.036)	(0.037)	(0.037)	(0.038)	(0.036)
AX task (ref. cat. = Slider)		-0.308***	-0.309***	-0.309***	-0.309***	-0.308***
		(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Simon task (ref. cat. = Slider)		-0.384***	-0.385***	-0.382***	-0.383***	-0.384***
		(0.030)	(0.030)	(0.030)	(0.030)	(0.030)

Parent university		0.268***	0.268***	0.268***	0.268***	0.268***
		(0.054)	(0.054)	(0.055)	(0.055)	(0.054)
Male		0.348***	0.348***	0.336***	0.336***	0.349***
		(0.056)	(0.056)	(0.056)	(0.056)	(0.056)
Age in months		0.007	0.007	0.006	0.006	0.007
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Fluid intelligence (stdsd)		0.202***	0.202***	0.197***	0.197***	0.203***
		(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Mouse use		0.100***	0.100***	0.101***	0.101***	0.100***
		(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Daily computer use - video games		0.022	0.022	0.028	0.028	0.022
		(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Number of older siblings		0.000	0.000	0.003	0.003	0.000
		(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Number of younger siblings		-0.059	-0.059	-0.058	-0.058	-0.059
		(0.031)	(0.031)	(0.030)	(0.030)	(0.031)
Speak Spanish/German at home		0.134	0.133	0.047	0.046	0.133
		(0.196)	(0.196)	(0.197)	(0.197)	(0.196)
Enjoyed ball game		-0.027	-0.027	-0.028	-0.028	-0.027
		(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Enjoyed task		0.161***	0.161***	0.157***	0.157***	0.161***
		(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Enjoyed puzzle game		-0.033	-0.033	-0.037	-0.037	-0.032
		(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Incentivised * Parental discipline			-0.019		-0.023	
			(0.045)		(0.045)	
Incentivised * Parental support			-0.046		-0.049	
			(0.068)		(0.069)	
Conscientiousness				-0.007	-0.007	
				(0.027)	(0.027)	
Need for cognition				0.088**	0.088**	
				(0.031)	(0.031)	
Delay of gratification				-0.032	-0.032	
				(0.025)	(0.025)	
Locus of control				0.009	0.008	
				(0.029)	(0.029)	
Parental discipline * Parental support						0.013
						(0.052)
Constant	-0.168***	-2.091***	-2.097***	-1.902**	-1.908**	-2.089***
	(0.045)	(0.600)	(0.600)	(0.599)	(0.599)	(0.600)
Class-level std dev	0.218***	0.055**	0.055**	0.049**	0.049**	0.054**
	(0.039)	(0.053)	(0.053)	(0.057)	(0.057)	(0.053)
Participant-level std dev	0.598***	0.504***	0.504***	0.499***	0.499***	0.504***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Observation-level std dev	0.756***	0.714***	0.714***	0.715***	0.715***	0.714***

	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
N	4703	3588	3588	3574	3574	3588

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

Table A2.4. *Regression of effort intensity (correct answers, standardised by task) - Berlin*

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Parental discipline	0.041	-0.020	-0.121	0.027	-0.134	-0.019
	(0.051)	(0.057)	(0.089)	(0.063)	(0.099)	(0.057)
Parental support	0.036	-0.024	-0.008	-0.041	0.002	-0.023
	(0.052)	(0.058)	(0.095)	(0.062)	(0.100)	(0.058)
Incentivised (ref. cat = Unincentivised)		0.460***	0.483***	0.466***	0.508***	0.461***
		(0.049)	(0.052)	(0.050)	(0.054)	(0.049)
AX task (ref. cat. = Slider)		0.330***	0.331***	0.332***	0.333***	0.330***
		(0.041)	(0.041)	(0.042)	(0.042)	(0.041)
Simon task (ref. cat. = Slider)		0.218***	0.219***	0.205***	0.205***	0.218***
		(0.042)	(0.042)	(0.043)	(0.043)	(0.042)
Parent university		0.164*	0.165*	0.155	0.156*	0.163*
		(0.076)	(0.076)	(0.079)	(0.079)	(0.077)
Male		0.333***	0.332***	0.331***	0.329***	0.332***
		(0.075)	(0.075)	(0.077)	(0.077)	(0.075)
Age in months		0.012*	0.012*	0.011	0.011	0.012*
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Fluid intelligence (stdsd)		0.233***	0.233***	0.229***	0.230***	0.232***
		(0.038)	(0.038)	(0.041)	(0.041)	(0.038)
Mouse use		0.047	0.046	0.046	0.045	0.046
		(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Daily computer use - video games		-0.019	-0.019	-0.029	-0.030	-0.018
		(0.031)	(0.031)	(0.034)	(0.034)	(0.031)
Number of older siblings		-0.075*	-0.076*	-0.088*	-0.087*	-0.075*
		(0.034)	(0.034)	(0.035)	(0.035)	(0.034)
Number of younger siblings		-0.102*	-0.103*	-0.115**	-0.115**	-0.102*
		(0.041)	(0.041)	(0.042)	(0.042)	(0.041)
Speak Spanish/German at home		0.128	0.128	0.138	0.139	0.122
		(0.159)	(0.159)	(0.164)	(0.164)	(0.161)
Enjoyed ball game		0.004	0.005	-0.003	-0.002	0.004
		(0.028)	(0.028)	(0.029)	(0.029)	(0.028)
Enjoyed task		0.087***	0.087***	0.074**	0.073**	0.087***
		(0.024)	(0.024)	(0.025)	(0.025)	(0.024)
Enjoyed puzzle game		-0.024	-0.024	-0.007	-0.007	-0.024
		(0.028)	(0.028)	(0.029)	(0.029)	(0.028)
Incentivised * Parental discipline			0.117		0.185*	
			(0.079)		(0.088)	
Incentivised * Parental support			-0.017		-0.045	

			(0.086)		(0.089)	
Conscientiousness				-0.034	-0.035	
				(0.045)	(0.045)	
Need for cognition				0.052	0.052	
				(0.038)	(0.038)	
Delay of gratification				-0.041	-0.043	
				(0.044)	(0.044)	
Locus of control				-0.016	-0.016	
				(0.037)	(0.037)	
Parental discipline * Parental support						0.017
						(0.080)
Constant	-0.046	-2.648***	-2.674***	-2.473**	-2.514**	-2.646***
	(0.063)	(0.781)	(0.781)	(0.791)	(0.791)	(0.781)
Class-level std dev	0.283***	0.112***	0.111***	0.099***	0.098***	0.111***
	(0.050)	(0.055)	(0.055)	(0.060)	(0.060)	(0.055)
Participant-level std dev	0.557***	0.482***	0.482***	0.479***	0.478***	0.482***
	(0.026)	(0.029)	(0.029)	(0.030)	(0.030)	(0.029)
Observation-level std dev	0.758***	0.720***	0.719***	0.711***	0.710***	0.720***
	(0.011)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
N	2849	1875	1875	1759	1759	1875

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

Appendix A3 Behavioural correlates of discipline and support

The following tables show the pairwise correlations between parental discipline, support, and a vector of behavioural or quasi-behavioural variables. The correlations are presented in two tables to facilitate legibility. Stars indicate statistically significant correlations at the 0.05 level.

Table A3.1. *Pairwise correlations between discipline, support, and behavioural variables*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Parental discipline	1.00								
(2) Parental support	-0.05*	1.00							
(3) Daily video game use	0.00	-0.04*	1.00						
(4) Daily computer video use	-0.02*	-0.09*	0.31*	1.00					
(5) Daily web surfing	-0.02*	-0.08*	0.46*	0.34*	1.00				
(6) Daily web chatting	-0.03*	-0.02*	0.27*	0.34*	0.39*	1.00			
(7) Daily computer homework use	0.06*	-0.01	0.12*	0.06*	0.13*	0.17*	1.00		
(8) Weekly pocket money	-0.02*	-0.05*	0.06*	0.02	0.04*	0.03*	0.05*	1.00	
(9) Last maths grade	0.13*	0.06*	-0.07*	-0.07*	-0.10*	-0.17*	-0.01	0.00	1.00

* p<0.05

Table A3.1. *Pairwise correlations between discipline, support, and behavioural variables*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Parental discipline	1.00								
(2) Parental support	-0.05	1.00							
(3) Skipped an entire day of school	-0.01	-0.05	1.00						
(4) Skipped some classes	0.03	-0.07*	0.43*	1.00					
(5) Arrived late for school	0.06*	-0.08*	0.23*	0.20*	1.00				
(6) Extracurricular sport	0.05	0.09*	-0.03	-0.02	-0.07*	1.00			
(7) Extracurricular music	0.02	0.01	0.02	0.01	0.05	0.10*	1.00		
(8) Extracurricular art	-0.06*	0.05	0.03	0.01	0.02	0.09*	0.29*	1.00	
(9) Homework daily time	0.10*	0.04	0.00	0.02	-0.03	0.04	0.01	0.04	1.00

* p<0.05

Appendix A4 Robustness to omitted variable bias

While we condition on a vector of "control" variates, it is impossible to claim that we have exogeneous variation in our independent variables of interest. It is plausible that the statistically significant partial correlations are affected by omitted variable bias. Nonetheless, this does not mean that we are entirely agnostic about the robustness of the effects either. In this section we implement Oster's method for setting bounds on how much confounding by unobserved variables might affect our estimates (Oster 2019).

Oster provides a method for approximating the parameter estimate on our independent variable of interest, adjusting for omitted variable bias caused by not controlling for unobserved confounders. The formula she gives for this is:

$$\beta^* \approx \tilde{\beta} - \delta[\dot{\beta} - \tilde{\beta}]\frac{R_{max} - \tilde{R}}{\tilde{R} - \dot{R}}$$

Here β^* is our bias-adjusted parameter of interest. $\dot{\beta}$ is our parameter of interest from a regression of the dependent variable on our independent variable of interest, without adjusting for observed confounders. $\tilde{\beta}$ is our parameter of interest from a regression of the dependent variable on our independent variable of interest, adjusting for observed confounders. $\dot{R}$ is the R-squared from the unadjusted regression, and $\tilde{R}$ is the r-squared for the adjusted regression. R_{max} is the R-squared from a theoretical regression of the dependent variable on the true population regression function – i.e. the vector of covariates that includes the observed and unobserved confounders.

The basic idea is to assess how indicative coefficient stability is of the robustness of our parameter estimate. In "classic" or "naïve" approaches to robustness, a researcher will first estimate a parameter $\dot{\beta}$, the coefficient on our independent variable of interest, without

"controlling" for potential confounders. Then, they estimate subsequent regressions where they include a full vector of observed (potential) confounders, which yields the revised coefficient estimate $\tilde{\beta}$. They then assess how much the parameter moves once controlling for observed confounders – i.e. the quantity $\dot{\beta} - \tilde{\beta}$. If this quantity is small – if the coefficient hasn't decreased (increase) by much – then the research concludes there is a high degree of coefficient stability, meaning that the estimated parameter is "robust".

There are two flaws in this "naïve" approach, concerning the δ and R_{max} quantity. The δ quantity is the ratio of the correlation between (i) the independent variable and the unobserved covariates; and (ii) the independent variable and the observed covariates. δ is termed the "coefficient of proportionality". If the vectors of unobserved and observed covariates are not orthogonal, then the former are residualised with respect to the latter.

If $\delta = 1$, these quantities are equivalent, meaning that the correlations between the independent variable and the observed and unobserved covariates are roughly equivalent. If $\delta < 1$, there is a greater correlation with the observed covariates – i.e. the researcher has identified most of the important confounders.

The R_{max} quantity is the R-squared from a theoretical regression of the dependent variable on the observed and unobserved covariates. Given measurement error, and other idiosyncratic components of the error term, this is not necessarily assumed to be 1 (Oster 2019). Hence $R_{max} - \tilde{R}$, the numerator in the fraction on right hand side of Oster's estimator, represents the difference in r-squareds between the true regression and the regression on the observables.

The point is that what $\dot{\beta} - \tilde{\beta}$ tells us about robustness depends on δ and $R_{max} - \tilde{R}$. If δ is large, and/or $R_{max} - \tilde{R}$ is large relative to $\tilde{R} - \dot{R}$, then $\tilde{\beta}$ will be fairly far away from β^*. In other words, if the unobserved covariates have a relatively large correlation with our independent variable, and when they account for a relatively large share of the variance in our dependent variable, $\tilde{\beta}$ will fairly seriously overestimate β^*.

Of course δ and R_{max} are unknown quantities, and Oster provides some plausible assumptions for them, drawing on the literature and an analysis of published articles in top economics journals. Firstly, she suggests that δ = 1 is an appropriate upper bound on δ (Oster 2019). This suggests that unobservables are at least as "important" as the observables. Since researchers typically gather data on, and adjust for, the regressors they believe to be most important [(Angrist and Pischke 2010), cited in (Oster 2019)], 1 seems a plausible upper bound for this

quantity. Moreover, the unobserved covariates likely also correlate with the observed ones, meaning that the latter effectively already partially "control" for the former (Oster 2019).

It is more difficult to find an intuitive upper bound for R_{max}. Let $R_{max} = \Pi\tilde{R}$. Based on re-analysis of published data, Oster suggests a bounding value of $\Pi = 1.3$. Again this suggests that the independent variable of interest and the observed covariates are somewhat "more important" than the unobserved covariates, which is a defendable assumption.

We implement Oster's approach in our to study the robustness of the interactions between our parenting variables and the incentive condition, across both effort direction and effort intensity. We assess the stability of these coefficients relative to an "empty" version of Model 3 without the vector of controls. For clarity we state both models here, denoting the empty model as M3e:

$$y_{ijk} = \dot{\beta}_0 + \dot{\beta}_1 Discipline_{jk} + \dot{\beta}_2 Support_{ijk} + \dot{\beta}_3 Extrinsic_{ijk} +$$

$$\dot{\beta}_4 Support_{jk} * Extrinsic_{ijk} + \dot{\beta}_5 Discipline_{jk} * Extrinsic_{ijk} + \gamma_k + \mu_j + \varepsilon_{ijk} \qquad (M3e)$$

$$y_{ijk} = \widetilde{\beta_0} + \widetilde{\beta_1}\text{Discipline}_{jk} + \widetilde{\beta_2}\text{Support}_{ijk} + \widetilde{\beta_3}\text{Extrinsic}_{ijk} +$$

$$\widetilde{\beta_4} Support_{jk} * Extrinsic_{ijk} + \widetilde{\beta_5} Discipline_{jk} * Extrinsic_{ijk} + XB + \gamma_k + \mu_j + \varepsilon_{ijk} \quad (M3)$$

Here XB denotes the vector of observed controls and, following Oster's notation, we have placed a tilde over the parameters from the fully-specified model and a dot over the parameters from the empty model.

For each of our parameters of interest, we estimate the following quantities. First, the difference in parameter estimates for variable h: $a * \left(\dot{\beta}_h - \widetilde{\beta_h}\right)$. Here, a is our "shrinkage sign parameter", which takes a value of either -1 or 1, depending on which value would shrink our estimate of β^* towards zero. This value depends on both the sign of $\widetilde{\beta_h}$, which may be less than zero, and the sign of $\dot{\beta}_h - \widetilde{\beta_h}$. In the latter case, it could happen that $\widetilde{\beta_h}$ is positive and greater than $\dot{\beta}_h$, meaning that the effect size increases in magnitude when adjusting for observable controls. Such cases we consider already good evidence of a robust association, but we include them in the analyses for completeness.

Second, $\tilde{R}$ and $\dot{R}$. This is a little less straightforward in our multilevel model setting than with OLS. We follow the procedure in (Nakagawa and Schielzeth 2013) to estimate the marginal R-squared. We then estimate theoretical values of β_h^*, our omitted variable bias-adjusted parameter on variable h, across varying values of Π, where $R_{max} = \Pi\tilde{R}$. We estimate this

quantity for $\delta = 0.5$ and $\delta = 1$. The values of these different quantities are given in Table A4.1 The relationship between β_h^* and Π for each parameter of interest is graphed in Figure A4.1 for effort direction, and Figure A4.2 for effort intensity. In the graphs, the vertical dashed blue line marks the value $\Pi = 1.3$, which Oster gives as an inductively plausible upper bound for R_{max}, based on her review of the literature (Oster 2019). The dashed vertical red line gives the value $\Pi = \tilde{R}/\dot{R}$ – i.e the value R_{max} would have if the unobserved covariates increased the r-squared by the same proportion compared to the increase caused by including the observed covariates.

Table A4.1. *Parameters for coefficient stability analysis*

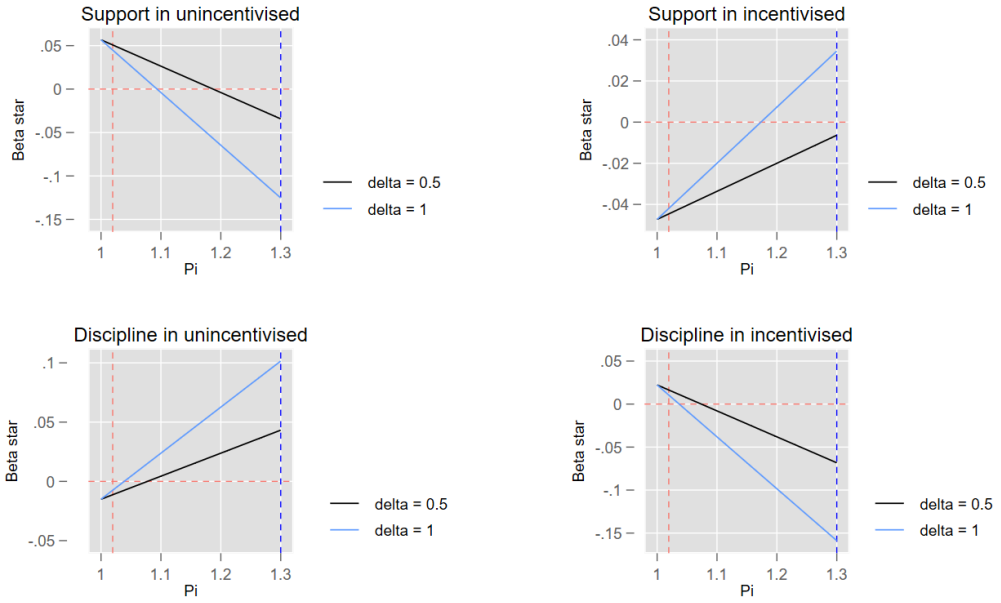
Dependent variable	**Parameter**	$\dot{\beta}_h$	$\widetilde{\beta_h}$	$\alpha * (\dot{\beta}_h - \widetilde{\beta_h})$	$\dot{R}$	$\tilde{R}$
Direction	Support (in unincentivised)	0.045	0.057	0.012	0.361	0.368
Direction	Support*incentivised	-0.042	-0.047	0.005	0.361	0.368
Direction	Discipline (in unincentivised)	-0.008	-0.015	0.007	0.361	0.368
Direction	Discipline*incentivised	0.011	0.022	-0.012	0.361	0.368
Direction	Support (in unincentivised)	0.078	0.013	0.065	0.049	0.060
Direction	Support*incentivised	-0.046	-0.039	-0.007	0.049	0.060
Direction	Discipline (in unincentivised)	0.071	0.053	0.018	0.049	0.060
Direction	Discipline*incentivised	0.022	-0.009	0.032	0.049	0.060

We focus our interpretation of the results to effort direction (Figure A3.1). We first look at "support in unincentivised", or the partial correlation on support when the incentivised dummy is zero. Looking at the graph in the top left, we see that the value of beta star reaches zero at about $\Pi = 1.1$, depending on whether $\delta = 0.5$ or $\delta = 1$. This is more than $\Pi = \tilde{R}/\dot{R}$, but less than the 1.3 upper bound. However, it should also be borne in mind that the estimate on parental support (in the unincentivized condition) actually increased when controls were added, and the graph represents the very pessimistic case that the unobserved controls would shrink the coefficient. Holistically then, we argue the partial correlation is robust. The case is stronger for the interaction between support and material incentives. Here the beta star reaches zero at $\Pi = 1.3$ when $\delta = 0.5$; when $\delta = 1$, beta star reaches zero at around $\Pi = 1.15$, but this is still greater than $\Pi = \tilde{R}/\dot{R}$. Again, this is under the conservative

assumption that including unobserved covariates will only reduce the absolute magnitude of the point estimate, when including the observed ones increased it.

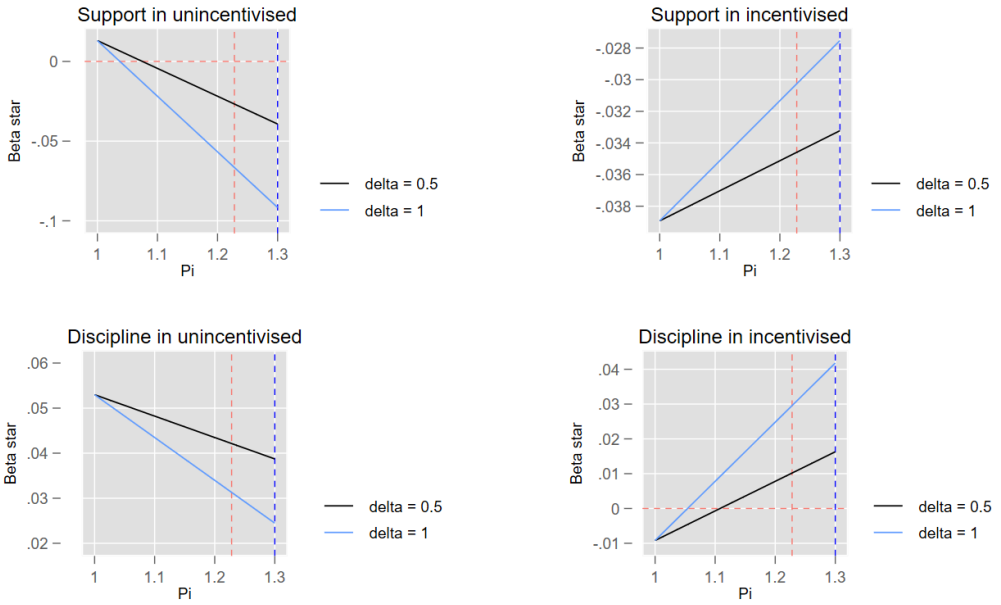
The robustness of the parameters on discipline in the intrinsic and discipline interacted with incentives is weaker. For both deltas, beta star reaches zero shy of the $\Pi = 1.05$ region, though they still exceed $\Pi = \tilde{R}/\dot{R}$.

Figure A4.1 Coefficient stability for effort direction



Dashed vertical red line gives ratio of r-squared in model with and without observed covariates.
Dashed vertical blue line gives the value of 1.3 times the r-squared in model with observed covariates.

Figure A4.2 Coefficient stability for effort intensity



Dashed vertical red line gives ratio of r-squared in model with and without observed covariates.
Dashed vertical blue line gives the value of 1.3 times the r-squared in model with observed covariates.

Regarding effort intensity, we note that while the coefficient on discipline in the unincentivised is marginally statistically insignificant (bottom left graph in Figure A4.2), it is rather robust to omitted variable bias.

Appendix A5 Intergenerational results

Table A5.1 presents results from the intergenerational sample of 230 parent-child dyads. 230 parents did the AX and Simon tasks under the incentivised condition. We matched the performance of their children in the incentivised conditions of these tasks to their parent in the task. In the analysis presented below, we estimate an interaction effect between discipline and parental effort and support and parental effort. The purpose of doing so is to see if discipline or support moderates the degree to which a parent transmits their own effort disposition to their children. If the association between parental and child effort is greater for more disciplinary (supportive) parents, this would indicate that more disciplinary (supportive) parents are better able to transmit their effort disposition to their children. There are up to two observations per parent-child dyad – one for each task. The results are also graphed in Figure A5.1 The models reveal no statistically significant interaction between parental discipline / support and parental effort.

Table A5.1 Moderating role of parental effort intensity

	Model 1	**Model 2**
Parental discipline	0.236**	0.163*
	(0.074)	(0.070)
Parental effort	0.187***	0.159***
	(0.048)	(0.048)
Parental discipline * Parental effort	0.015	0.043
	(0.055)	(0.054)
Parental support	0.073	0.098
	(0.100)	(0.095)
Parental support * Parental effort	-0.006	0.042
	(0.089)	(0.093)
AX task (ref. cat. = Slider)		-0.110
		(0.079)
Parent university		0.205
		(0.118)
Male		0.444***
		(0.107)
Age in months		-0.009
		(0.011)
Fluid intelligence (stdsd)		0.184**
		(0.059)

Mouse use		0.037
		(0.050)
Daily computer use - video games		0.104*
		(0.052)
Number of older siblings		0.037
		(0.068)
Number of younger siblings		0.027
		(0.054)
Speak Spanish/German at home		0.819*
		(0.378)
Enjoyed task		0.164**
		(0.055)
Enjoyed ball game		-0.044
		(0.043)
Enjoyed puzzle game		0.075
		(0.048)
Berlin		0.688***
		(0.147)
Constant	0.031	-1.103
	(0.084)	(1.480)
Class-level std dev	0.439***	0.245***
	(0.076)	(0.078)
Participant-level std dev	0.487***	0.349***
	(0.067)	(0.078)
Observation-level std dev	0.707***	0.658***
	(0.038)	(0.040)
N	358	290

Standard errors in parentheses
* p<05 ** p<0.01 *** p<0.001

Figure A5.1 Moderating role of parental effort