Parenting Style as an Investment in Human Development

Deborah A. Cobb-Clark, Nicolás Salamanca, and Anna Zhu

Online Appendix

Appendix A

Parenting Model with Linear Parenting Technologies and Cobb-Douglas Human Development

In this appendix we develop the comparative statics presented in Section *3.3.1* of the paper, making two key assumptions that allow us to find closed-form analytical solutions. First, we assume that parenting technologies are linear, which implies that each additional unit of input produces a constant amount of parenting investment. Second, we assume that the human development function is Cobb-Douglas, which implies that parental investments have a constant elasticity of substitution of one in the production of human development (i.e., a one percent change in the relative marginal productivity of parental investments will result in a one percent change in their relative use). The equations in this appendix are numbered parallel to the equation numbering in the main text, so that the results here can be easily mapped into the general discussion of the paper.

From the simplified version of the model discussed in Section *3.3.1* and our additional assumptions, we can express human development as:

$$Q = \Theta(Z_x)^{\alpha_x}(Z_t)^{\alpha_t}(Z_a)^{\alpha_a} \tag{A2}$$

where each of the parental investments is

$$Z_x = \beta_x \cdot x \tag{A3.1}$$

$$Z_t = \beta_t \cdot t \tag{A3.2}$$

$$Z_a = \beta_a \cdot a. \tag{A3.3}$$

In Equation (A2), Θ is the total factor productivity for human development and α_j, $j = x, t, a$ are Cobb-Douglas output elasticities. In Equations (A3.1) through (A3.3), β_j are the marginal productivities for a unit of each input. The usual restrictions apply, meaning that $\alpha_j, \beta_j > 0 \ \forall j$,

Accepted Manuscript

$\sum_j \alpha_j = 1$, and $\sum_j \beta_j = 1$. The household's input constrains, which are simplifications of Equations (4), (5), and (6) are:[1]

$$T^P = t_w + t \tag{A4}$$

$$A^P = a_w + a \tag{A5}$$

$$w \cdot t_w \cdot a_w = p \cdot x \tag{A6}$$

The Lagrangian for this maximization problem is therefore:

$$L = \Theta(\beta_x x)^{\alpha_x}(\beta_t t)^{\alpha_t}(\beta_a a)^{\alpha_a} + \lambda[w \cdot (T^P - t) \cdot (A^P - a) - p \cdot x] \tag{A9}$$

The usual first-order conditions for an interior solution are characterized by a system of four equations (the partial derivatives of L against x, t, a, and λ, all equal to zero) and four unknowns (x, t, a, and λ). Solving this system yields:

$$x^* = \frac{A^P T^P w \alpha_x^2}{p(\alpha_x + \alpha_t)(\alpha_x + \alpha_a)} \tag{13a}$$

$$t^* = \frac{T^P \alpha_t}{\alpha_x + \alpha_t} \tag{13b}$$

$$a^* = \frac{A^P \alpha_a}{\alpha_x + \alpha_a}. \tag{13c}$$

These solutions can be seen as expressions of the optimal (Marshallian) demands of parents for parenting inputs of market goods, time, and attention, all of which are expressed as functions of factors that are exogenous from the perspective of the parents. Substituting these solutions into $Z_j = \beta_j \cdot j$ for $j = x, t, a$ yields the optimal choice of parenting investments Z_x^*, Z_t^*, and Z_a^*.

These results make it straight-forward to obtain comparative statics that describe the predicted change in parenting styles associated with changes in parenting attention, the price of market goods, and wage rates. Table A1 presents the same set of comparative statics as given in Table 1. As a result of the additional functional form assumptions made here, the comparative statics in Table A1 can be unambiguously signed, leading to predictions regarding

[1] For simplicity, we ignore here the role of non-market income, V^P.

Accepted Manuscript

the response of parental investments to exogenous changes in parenting attention, prices, and wages.

Strictly positive quantities are shown in **bold**. When parenting technologies are linear in their inputs and human development is Cobb-Douglas in parenting investments, our model unambiguously predicts, for example, that an exogenous increase in parenting attention (A^P) will increase parents' use of market goods-intensive investments relative to time-intensive investments. To see this, consider the following. The results in Table A1 indicate that the derivative of R_x^t with respect to A^P is positive. Recall that R_x^t is defined in in Equation (11a) as $\frac{\partial Q}{\partial Z_t}/\frac{\partial Q}{\partial Z_x}$, i.e. the relative marginal productivities of time-intensive versus goods-intensive parenting investments. As these marginal productivities change, there is a corresponding change in the optimal level of time-intensive (Z_t) relative to goods-intensive (Z_x) parenting investments. The consequences of an increase in R_x^t are illustrated in Figure A1. The graph on the right depicts the optimal level of time-intensive parenting investments, while the graph on the left depicts optimal goods-intensive investments. Suppose that initially (period 0) investments are given by Z_t^0 and Z_x^0 implying that the relative productivity of these alternative investment types (R_x^{t0}) is given by the ratio of the slopes of their tangent lines. An increase in the marginal productivity of time-intensive investments relative to goods-intensive investments in period 1, i.e. $R_x^{t1} > R_{x,}^{t0}$, will be associated with an increase in Z_x relative to Z_t. This general intuition can be applied for to the interpretation of all comparative statics in Tables 1 and A1.

Accepted Manuscript

Table A1

COMPARATIVE STATICS WITH LINEAR PARENTING TECHNOLOGIES AND A COBB-DOUGLAS CHILD DEVELOPMENT FUNCTION

Partial derivative of:	*In model:*	**With respect to:** $\frac{\partial}{\partial A^P}$	$\frac{\partial}{\partial p}$	$\frac{\partial}{\partial w}$
R_x^t	*Parenting*	$\frac{\mathbf{w}\,\boldsymbol{\beta}_x}{\mathbf{p}\,\boldsymbol{\beta}_t}\frac{\boldsymbol{\alpha}_x}{(\boldsymbol{\alpha}_x+\boldsymbol{\alpha}_a)}$	$-\frac{w\beta_x A^P}{p^2\beta_t}\frac{\alpha_x}{(\alpha_x+\alpha_a)}$	$\frac{\mathbf{A^P}\boldsymbol{\beta}_x}{\mathbf{p}\boldsymbol{\beta}_t}\frac{\boldsymbol{\alpha}_x}{(\boldsymbol{\alpha}_x+\boldsymbol{\alpha}_a)}$
	Traditional	0	$-\frac{w\beta_x}{p^2\beta_t}$	$\frac{\boldsymbol{\beta}_x}{\boldsymbol{\beta}_t\mathbf{p}}$
R_x^a	*Parenting*	0	0	0
	Traditional	N/A	N/A	N/A
R_t^a	*Parenting*	$-\frac{T^P\beta_t}{A^{P2}\beta_a}\frac{(\alpha_x+\alpha_a)^2}{\alpha_x(\alpha_x+\alpha_t)}$	0	0
	Traditional	N/A	N/A	N/A

Accepted Manuscript

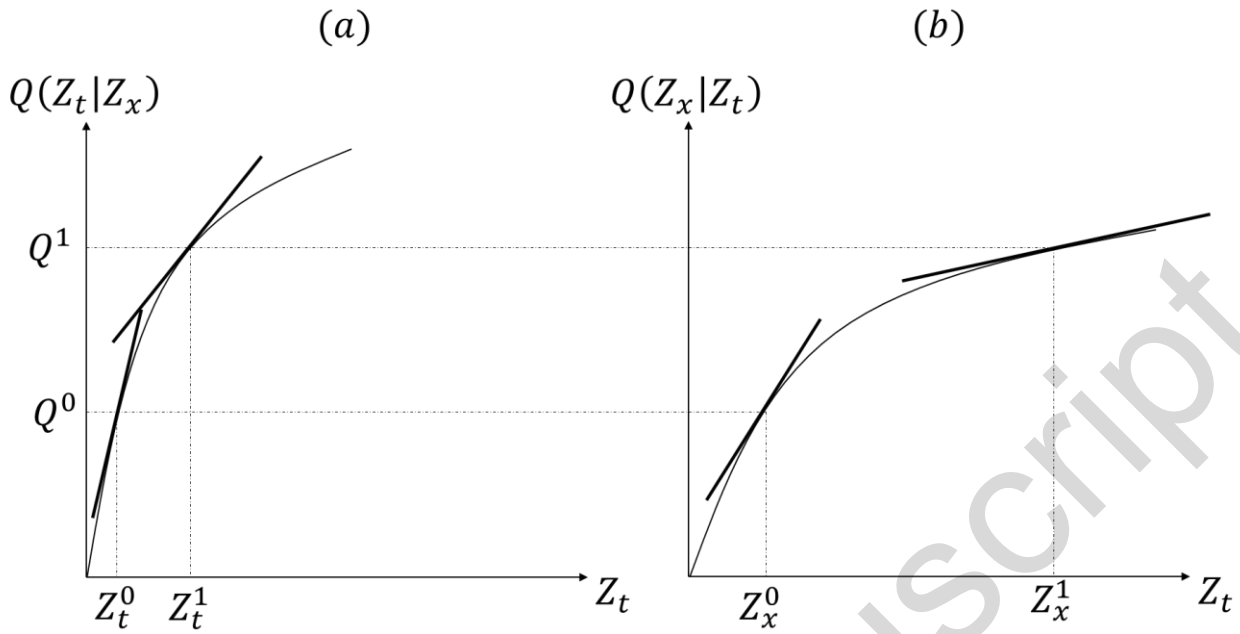

Fig. A1.—An increase in the use of market-goods over time investments

Accepted Manuscript

Appendix B

Additional Tables

Table B1
DEFINITIONS AND CODING OF THE MAIN VARIABLES

Variable Name	*Description*	*Range and Coding*
Goods- and Time-Intensive Interactions:		
Parent helps youth with money	Based on the following questions asked to parent: 1. *Are you currently living with [Focal Youth]?* 2. *Does [Focal Youth] pay any rent or board to you to live at home?* 3. *Have you helped [Focal Youth] with [payment] in the past 12 months?* Payments Considered: Mortgage, bills, vehicle purchase, study-related costs, general living expenses	Categorical, 0 - 5: 0 - Not living at home, no monetary help 1 - Not living at home, some help with mortgage and bills 2 - Living at home but paying rent, no monetary help 3 - Living at home but paying rent, some monetary help 4 - Living at home and not paying rent, no monetary help 5 - Living at home and not paying rent, some monetary help
1 if parents don't expect money aid to be repaid	Asked to parent: *Thinking about the ways in which you have helped [Focal Youth] financially, do you consider this help to have been primarily a loan or a gift? In other words, do you expect to be paid back or not?*	Dummy, 1 if parent does not expect money to be paid back
Parent: Participated in parent committee/meetings	Asked to parent: *Were you or [Focal Youth]'s /mother/father/ involved in parent committee activities for more than one year?*	Dummy, 1 if involved
Number of youth's extracurricular activities	Total sum of the activities mentioned in the following question asked to parent: *While attending secondary school, did [Focal Youth] participate in any organised activities after school or on weekends, such as sports, gymnastics, dance, scouts, clubs or religious groups?*	Continuous, 0 - 43
Youth: Parents read to me at night when younger	Asked to youth in self-completed questionnaire: *When you were younger did your parent(s) or other persons responsible for you read to you at night?*	Categorical, 1 (Not at all) - 5 (Every night)

(continued below)

Accepted Manuscript

(Table B1 continued from above)

Variable Name	*Description*	*Range and Coding*
Attention-intensive Interactions:		
Youth: Mother respects my views and opinions	Asked to youth: *Your mother respects your ideas and opinions about the important things in life.*	Categorical, 1 (Never true) - 7 (Always)
Parent: I can respect youth's views and opinions	Asked to parent: *[Focal Youth]'s ideas and opinions about the important things in life are ones you can respect?*	Categorical, 1 (Never true) - 7 (Always)
Youth: Mother's behavior towards me is friendly	Asked to youth: *Overall, how would you characterize your relationship with your mother? Would you say it is always friendly, often friendly usually friendly, sometimes friendly, hardly ever friendly or never friendly?*	Categorical, 1 (Never true) - 7 (Always)
Youth: Mother knows my friends	Asked to youth in self-completed questionnaire: *Does your mother know who your friends are?*	Categorical, 1 - 3 1 - Does not know any of my friends 2 - Knows some of my friends 3 - Knows all of my friends
Youth: Mother wants to know whereabouts	Total sum of the following questions asked to youth in self-completed questionnaire: *How much does your mother want to know about:* 1. *Where you go at night?* 2. *What you do with your free time?* 3. *Where you are most days after school or in the afternoon?* Answer values are: − Doesn't want to know (1) − Wants to know a little (2) − Expects to know (3)	Continuous, 1 - 9
Youth: Mother really knows whereabouts	Total sum of the following questions asked to youth in self-completed questionnaire: *How much does your mother really know about:* 1. *Where you go at night?* 2. *What you do with your free time?* 3. *Where you are most days after school or in the afternoon?* Answer values are: − Doesn't know (1) − Knows a little (2) − Knows a lot (3)	Continuous, 1 - 9
Youth: Parents help with schoolwork & guidance when younger	Asked to youth in self-completed questionnaire: *Did your parent(s) or other persons responsible for you help you with such things as school work, choosing your options, or preparing for exams?*	Categorical, 1 (Not at all) - 5 (All the time)

(continued below)

Accepted Manuscript

(Table B1 continued from above)

Variable Name	*Description*	*Range and Coding*
Other variables:		
Youth's internal LOC	Total sum of the following questions asked to parents and youth: 1. *There is really no way I can solve some of the problems I have (reversed)* 2. *Sometimes I feel that I'm being pushed around in life (reversed)* 3. *I have little control over the things that happen to me (reversed)* 4. *I can do just about anything I really set my mind to* 5. *I often feel helpless in dealing with the problems of life (reversed)* 6. *What happens to me in the future mostly depends on me* 7. *There is little I can do to change many of the important things in my life (reversed)* Answer values for each question are 1 (Strongly Disagree) to 4 (Strongly Agree)	Continuous, 7 - 28
1 if youth graduated high school	Based on the following questions asked to youth: 1. *Are you still going to secondary school or have you left school?* 2. *What year were you in when you left school?*	Dummy, 1 if not in school and completed year 12
Youth's University Entrance Score (N=715)	Asked to youth: *If taken /a University Admission Index (UAI)/ /an Equivalent Tertiary Entrance Rank (ENTER)/ /an Overall Position (OP)/ /a Tertiary Entrance Rank (TER)/ /a University entrance score/, what was your score?*	continuous, 1 - 100
Parent's age	Based on year of birth in Centrelink, and updated by interviewer if needed	
1 if parent completed high school	Asked to parent: *What is the highest level of primary or secondary school you have completed?*	Dummy, 1 if Year 12 or equivalent
1 if parent completed university	Asked to parent: *What is the highest qualification you have completed since leaving secondary school?*	Dummy, 1 if Bachelor Degree or above
1 if parent is foreign-born	Asked to parent: *In which country were you born?*	Dummy, 1 if Not in Australia
1 if parent aboriginal	Asked to parent: *Are you of Aboriginal or Torres Strait Islander origin?*	Dummy, 1 if Aboriginal and/or Torres Strait Islander

Accepted Manuscript

Table B2
SUMMARY STATISTICS

	All	By Welfare Support History:		
		<6 years	*6+years*	*Difference*
	(N=1,358)	(N=1,002)	(N=356)	[p-value]
Goods- and Time-intensive interactions:				
Parent helps youth with money	3.92	4.10	3.40	[0.000]
1 if parents don't expect money aid to be repaid	0.83	0.84	0.82	[0.353]
Parent: Participated in parent committee/meetings	1.21	1.26	1.07	[0.001]
Number of youth's extracurricular activities	1.67	1.79	1.34	[0.000]
Youth: Parents read to me at night when younger	3.47	3.53	3.31	[0.003]
Parenting style interactions:				
Parent: I can respect youth's views and opinions	5.05	5.07	5.00	[0.266]
Youth: Mother respects my views and opinions	5.12	5.15	5.02	[0.058]
Youth: Mother's behavior towards me is friendly	5.44	5.44	5.45	[0.794]
Youth: Mother knows my friends	2.42	2.43	2.40	[0.428]
Youth: Mother wants to know whereabouts	6.99	7.08	6.72	[0.000]
Youth: Mother really knows whereabouts	7.30	7.35	7.18	[0.118]
Youth: Parents help with schoolwork & guidance when younger	3.67	3.72	3.55	[0.013]
Youth outcomes:				
Youth's internal LOC	0.00	0.04	-0.12	[0.010]
1 if youth graduated high school	0.72	0.76	0.60	[0.000]
Youth's University Entrance Score (N=715)	74.72	75.39	71.56	[0.027]
1 if youth engaged in risky behaviors	0.41	0.37	0.51	[0.001]
Parent's background:				
Parent's age	47.06	47.43	46.03	[0.000]
1 if parent completed high school	0.46	0.50	0.33	[0.000]
1 if parent completed university	0.21	0.24	0.12	[0.000]
1 if parent is foreign-born	0.21	0.21	0.21	[0.909]
1 if parent aboriginal	0.02	0.01	0.04	[0.003]
Parent's current socioeconomic information:				
Log. of total earnings	8.24	8.85	6.53	[0.000]
1 if zero earnings reported	0.24	0.20	0.34	[0.000]
1 if parent is unemployed	0.20	0.14	0.36	[0.000]
Mother’s internal LOC	0.00	0.07	-0.21	[0.000]
1 if parent was ever diagnosed with asthma	0.18	0.17	0.22	[0.058]
1 if parent was ever diagnosed with depression	0.24	0.20	0.34	[0.000]
1 if parent ever diagnosed with physical disability	0.15	0.13	0.21	[0.002]
1 if parent ever diagnosed with learning disability	0.02	0.01	0.04	[0.027]

This table reports the mean value of the all relevant measures for our analyses. The first column reports mean values for the estimation sample. The second and third columns report means for the advantaged and disadvantaged subpopulations based on the intensity of welfare support use while the youth was growing up. The fourth column reports the p-value of a two-sided t-test of the difference between the advantaged and disadvantaged means. These tests are based on heteroscedasticity robust standard errors.

Accepted Manuscript

Table B3
EXPLORATORY PRINCIPAL COMPONENT ANALYSIS OF ALL PARENT-CHILD INTERACTIONS

	Exploratory Principal Component Analysis				
	Component 1	*Component 2*	*Component 3*	*Component 4*	*Component 5*
Eigenvalues =	2.89	1.42	1.28	1.15	1.02
Variation captured =	0.24	0.11	0.10	0.09	0.08
Parent helps youth with money	0.17	**0.55**	-0.23	0.06	0.14
1 if parents don't expect money aid to be repaid	0.05	0.24	-0.18	**0.66**	-0.30
Parent: Participated in parent committee/meetings	0.14	0.06	**0.59**	0.00	**0.38**
Number of youth's extracurricular activities	0.15	0.10	**0.49**	0.27	**0.35**
Youth: Parents read to me at night when younger	**0.30**	-0.03	**0.35**	0.07	**-0.53**
Parent: I can respect youth's views and opinions	0.28	-0.05	-0.09	**0.48**	0.12
Youth: Mother respects my views and opinions	**0.36**	**-0.37**	-0.22	0.10	0.27
Youth: Mother's behavior towards me is friendly	**0.37**	**-0.37**	-0.27	0.06	0.21
Youth: Mother knows my friends	**0.31**	-0.14	-0.02	**-0.33**	-0.08
Youth: Mother wants to know whereabouts	**0.30**	**0.51**	-0.06	-0.24	0.08
Youth: Mother really knows whereabouts	**0.41**	0.23	-0.18	-0.25	0.01
Youth: Parents help with schoolwork & guidance when younger	**0.36**	-0.10	0.23	-0.06	**-0.45**

This table reports the result of a Principal Component Analysis (PCA) on all parent-child interaction measures. The PCA is based on tetrachoric, polychoric and polyserial correlations of the measures. The components are orthogonal and unrotated. We keep the first five components based on the criterion of eigenvalues larger than one. Factor loadings greater than 0.3 in absolute value are reported in bold.

Accepted Manuscript

Table B4
CORRELATIONS BETWEEN PARENTING INDICES

	Parenting style index	Goods-intensive investment index	Time-intensive investment index
Parenting style index	1		
Goods-intensive investment index	0.22	1	
Time-intensive investment index	0.28	0.05	1

This table reports Pearson correlations between Alpha indices of parenting style (7 underlying items), goods-intensive investments (2 underlying items), and time-intensive investments (3 underlying items). N=1,358.

Accepted Manuscript

Table B5
PARENTING INDICES AND YOUTH OUTCOMES

	Youth outcomes:			
	High School Graduation	University Entrance Score	Internal Locus of Control	Risky Behavior
	(1)	(2)	(3)	(4)
Parenting style index	0.043**	2.584**	0.403***	-0.170***
	(0.021)	(1.161)	(0.047)	(0.020)
Money-related investments index	0.037***	0.571	-0.046	-0.039**
	(0.014)	(0.732)	(0.032)	(0.015)
Time-related investments index	0.072***	2.222**	0.133***	-0.032*
	(0.017)	(0.895)	(0.039)	(0.019)
Observations	1,358	715	1,341	1,358
R-squared	0.06	0.12	0.09	0.09

*This table reports least squares regression coefficients on the following youth outcomes: a high school graduation dummy, University Entrance Scores, internal Locus of Control scores, and risky behavior dummy. These youth outcome variables are regressed on Alpha indices of parenting style (7 underlying items), goods-intensive investments (2 underlying items), and time-intensive investments (3 underlying items). All regressions control for parent's background (with unreported coefficients), which includes age, education, and foreign-born and aboriginal status. Heteroscedasticity robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Accepted Manuscript