

SUPPLEMENT TO “PRESIDENTIAL ADDRESS: ECONOMICS AND MEASUREMENT: NEW MEASURES TO MODEL DECISION MAKING”  
(*Econometrica*, Vol. 92, No. 4, July 2024, 947–978)

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## A1. SUPPORTING REFERENCES

THIS APPENDIX SECTION PROVIDES DETAILS on the relevant literature that was not presented for the different topics discussed in Sections 2 and 3 of the main text. This was not included in the main text because of page length limitations. We report the supporting references organized along the topics from Sections 2 and 3.

### A1.1. *The Context*

In addition to the studies cited in the main text, we suggest the following references:

*Contingent Valuation and Hypothetical Choices.* A good survey of contingent valuation’s use in other disciplines such as marketing is in [Louviere, Hensher, and Swait \(2000\)](#) and [Carson \(2012\)](#). Additionally, several studies, including [List and Gallet \(2001\)](#) and [Murphy, Geoffrey, Stevens, and Weatherhead \(2005\)](#), discuss common biases in answers to hypothetical situations questions.

*Stated Preferences, Conjoint Analysis, and Choice Data.* An example of the arguments about what and how to measure can be found in [Luce \(1959\)](#), [Luce and Tukey \(1964\)](#), and [Luce and Suppes \(1965\)](#). The reliability and predictive power of buying intentions and purchasing probabilities data are discussed in [Juster \(1966\)](#). [Curtin \(2016\)](#) provides a nice survey. Studies of stated preferences and answers to hypothetical questions include [Blass, Lach, and Manski \(2010\)](#), [Kesternich, Heiss, McFadden, and Winter \(2013\)](#), and [Ben-Akiva et al. \(2019\)](#). A recent example which considers explicitly how data on hypothetical choices can be used to identify causal links in economic models is [Bernheim, Bjorkegren, Naecker, and Pollmann \(2021\)](#). Other related studies are [Harris and Keane \(1998\)](#) and [Erdem, Keane, Öncü, and Strebel \(2005\)](#).

*Experimental Economics.* Evidence on measures of preference and attitudes towards redistribution, attitudes towards migrants, bargaining and social preferences, reciprocity

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in conflict areas, and willingness to compete through experiments combined with observational data are reported in [Almås, Cappelen, and Tungodden \(2020\)](#), [Alesina, Stantcheva, and Teso \(2018\)](#), [Almås, Armand, Attanasio, and Carneiro \(2018\)](#), [Buser, Niederle, and Oosterbeek \(2014\)](#), [Cavatorta and Groom \(2020\)](#). There is also evidence on how actual data have been reproduced in the lab, in particular for the analysis of auction models, for instance, [Ertaç, Hortaçsu, and Roberts \(2011\)](#), [Salz and Vespa \(2020\)](#).

*Subjective Expectations.* An example of early collection of subjective expectations is [Visco \(1984\)](#). Important references include [Dominitz and Manski \(1997\)](#), [Dominitz and Manski \(1996\)](#), [Potter, Del Negro, Topa, and van der Klaauw \(2017\)](#). A non-exhaustive list of studies using subjective expectations data include [Jappelli and Pistaferri \(2000\)](#), [Pistaferri \(2001\)](#), [Pistaferri \(2003\)](#), [van der Klaauw and Wolpin \(2008\)](#), [Kaufmann and Pistaferri \(2009\)](#), [Attanasio and Augsburg \(2016\)](#), [Paiella and Pistaferri \(2017\)](#), [Attanasio, Augsburg, and De Haas \(2018\)](#), and [Giustinelli, Manski, and Molinari \(2019\)](#). A recent example of high-quality subjective expectations data are those collected by the Federal Reserve Bank of New York: the *Survey of Consumer Expectations* (<https://www.newyorkfed.org/microeconomics/sce/background.html>).

[Chen, Hansen, and Hansen \(2020\)](#) showed that, without assuming rational expectations (or data on subjective expectations), only set (rather than point) identification can be achieved.

*Beliefs.* In addition to those cited in the text, several studies look at the elicitation of subjective beliefs. For instance, [Boneva and Rauh \(2018\)](#), [Dominitz and Manski \(1996\)](#), [Wiswall and Zafar \(2015\)](#), and [Delavande and Zafar \(2019\)](#) have studied beliefs about the returns to college and college enrollment choices, [Bobba and Frisancho \(2020\)](#) assessed how college application choices are affected by students' perceptions of their own ability and how these can be changed by additional information, while [Dizon-Ross \(2019\)](#) studied how parental beliefs about their children's abilities affect their choices.

### A1.2. *Measurement and Theory*

In addition to the studies cited in the main text, the following references are important for the relationship between theory and measurement:

*National Accounts.* Classic studies that led to the development of Modern National Accounts include [Keynes \(1936\)](#), [Kuznets \(1937\)](#), [Kuznets \(1941\)](#), and [Stone \(1984\)](#). Recent examples for the effects of new products and quality on the measurement of inflation include [Bils and Klenow \(2001\)](#), [Bils \(2009\)](#), and [Crawford and Neary \(2021\)](#); [Aghion, Bergeaud, Boppart, Klenow, and Li \(2019\)](#) for the importance of *creative destruction* to measure growth; and [Neary \(2004\)](#) and [Almås \(2012a\)](#) for international comparisons.

*Prices.* In many contexts, researchers use measures of unobserved latent factors that are the result of complex algorithms and procedures that summarize very large raw data. An obvious example is that of consumer price indices, whose weights to aggregate a myriad of different prices are based on certain models of demand behavior and are periodically updated using new data on consumption baskets purchased by consumers. The formulation of the '*measurement system*', mapping available data (the prices of many individual commodities) into a construct of interest (a price index), is driven by specific theoretical models of individual behavior, and is periodically updated to reflect changes

in behavior caused, for example, by the introduction of new commodities or improvements in their quality. For price indices, see Stone (1954), Christensen, Jorgenson, and Lau (1975), Deaton and Muellbauer (1980), and more recently Nordhaus (1998). However, in some contexts prices may not be linear and change with the quantity purchased, as in many models of price discrimination (e.g., Maskin and Riley (1984), Jullien (2000), and Attanasio and Pastorino (2020)). Recent progress has been made with the analysis of scanner data (Einav, Leibtag, and Nevo (2008), Griffith and O’Connell (2009), Dubois, Griffith, and O’Connell (2020)).

*Multiple Indicators Multiple Causes (MIMIC) Models.* References on this include Wright (1934), Duncan (1966), Goldberger (1971), Goldberger (1972), Griliches (1974), Jöreskog and Goldberger (1975), and Chamberlain and Griliches (1975).

*Labor Markets and Production Functions.* Studies of models to explain recent increases in inequality complemented by innovative data include, for instance, Deming (2017), Acemoglu and Restrepo (2019), Bloom et al. (2019), and Scur, Sadun, Van Reenen, Lemos, and Bloom (2021).

*Decision Units.* A number of important theoretical results have been derived within the collective model of Chiappori (1988, 1992), Browning and Chiappori (1998), Bourguignon, Browning, and Chiappori (2009), Cherchye, De Rock, and Vermeulen (2011). Attanasio and Lechene (2014) presented tests of the collective model using the variability induced in a standard household demand curve by two different *distribution factors*, that is, variables that affect Pareto weights but not utility. Characterizing the parameters of these models and testing their validity exclusively with *choice data* on household consumption and expenditure data might be challenging. A number of papers use individual-level data within households, for instance Dunbar, Lewbel, and Pendakur (2013), and more recently Lechene, Pendakur, and Wolf (2022), though strong assumptions are required to identify the determinants of individual behavior.

*Elicitation of Preferences and Beliefs.* With an *experimental approach*, researchers can place individuals in identical settings—and hence should have the same beliefs—and then elicit preferences through real (incentivized) choices. One example of such an approach in the literature on preferences for redistribution is Almås, Cappelen, and Tungodden (2020). A similar approach has also recently been used in the study of household decision making: Cherchye, Chiappori, De Rock, Ringdal, and Vermeulen (2021) studied actual choices in an economic experiment for married couples in Nairobi, Kenya. In the experiment, parents were asked to allocate money between themselves and nutritious meals for one of their children. From these choices, the authors tested models of household decision making and they estimated a parametric (structural) model of household collective decision making. Through this, they revealed preferences and Pareto weights related to bargaining power. The stated preference method instead fixes beliefs by giving respondents a set of hypothetical scenarios or choices where there is full information about the relevant parameters in each scenario. An early example of such a strategy can be found in the aforementioned Juster (1964) and Juster and Shay (1964). More recently, Ameriks, Briggs, Caplin, Shapiro, and Tonetti (2020) and Bernheim et al. (2021) have used hypothetical questions to estimate parameters that characterize individual preferences. Within such an approach, one can use answers to hypothetical questions to identify *preferences*, so that beliefs can then be inferred when these data are considered jointly with *choice data*.

Furthermore, instead of eliciting beliefs (preferences) and inferring preferences (beliefs) as a residual by combining elicitation choice data, one may directly elicit *both* beliefs and preferences in particular choice situations, where both heterogeneities in tastes and beliefs might be important. Adams and Andrew (2019) suggested using *survey experiments* to elicit *average* beliefs and preferences in the Indian (specifically Rajasthani) marriage market for young brides. In addition to the papers cited in the main text, List, Pernaudet, and Suskind (2021) have elicited beliefs from parents in Chicago. Bobba and Frisncho (2020) collected and used data on self-perceptions of academic achievement among high school students in Mexico; Miller, de Paula, and Valente (2020) studied beliefs about contraception effectiveness.

*Social Capital.* In the literature there are different approaches to measure social capital. Some papers consider measures of participation in certain activities (from blood donation to church attendance, see, e.g., Guiso, Sapienza, and Zingales (2004) and Guiso, Sapienza, and Zingales (2006)). Other studies use data derived from field experiments. Attanasio, Barr, Cardenas, Genicot, and Meghir (2012)) study the relation between social capital and group formation, while Cavatorta and Groom (2020) consider the effect of deterrence on preferences.

*Measures of Child Development.* The UN has facilitated the development of the Multiple Indicator Cluster Survey (MICS), which has recently been discussed in Bornstein et al. (2021). The Gates Foundation has funded a large effort to pull together a number of new indicators that could be comparable across contexts and countries and would be relatively easy to administer. This has given rise to the Global Scale for Early Development (GSED) initiative, discussed in GSED (2021) and Black et al. (2019). McCoy, Seiden, Waldman, and Fink (2021) described the construction and use of the CREDI questionnaire.

*New Measures.* Examples of new measures include Ferrario and Stantcheva (2022) on using text analysis of open-ended questions and the work on perceptions about several issues (Alesina, Miano, and Stantcheva (2023), Stantcheva (2022), Alesina, Ferroni, and Stantcheva (2021)).

## A2. SPECIFICATION OF MEASUREMENT SYSTEMS

This appendix provides more details on the general issues in the specification and estimation of measurement systems that were discussed in Section 5.1 of the main text.

One assumption that can be relaxed in the context of the measurement system, and that we mention in the main text, is that of linearity, especially when the available measures are binary or discrete. Here, we explain the logic. In such a situation, a common approach model is the Item Response Theory (IRT). In the case of binary measures, an IRT model relates a factor to a latent measure, which in turn determines the observed outcome. Omitting the superscript for the latent factor  $\theta$ , we have

$$m_{it}^k = \begin{cases} 1 & \text{if } \alpha_t^k + \beta_t^k \theta_{it} + \epsilon_{it}^k > 0, \\ 0, & \text{otherwise.} \end{cases} \quad (\text{A1})$$

The specific IRT model is then determined by assumptions about the distribution of the measurement error term  $\epsilon_{it}^k$ : assuming normality, one gets a *Probit* type of model; assuming a logistic distribution, one obtains a logistic relation, or what is usually referred to as a

Rasch model. What we are considering is often defined as a two-parameter Rasch model. Restricting  $\beta_i^k$  to 1, one obtains a one-parameter Rasch model. In the literature, a three-parameter Rasch model considers the possibility of random ‘correct’ answers through an additional parameter.

Another more recent example of IRT use, whose use has become more common in economics, is that of polygenic scores, which aggregate data from many different sites of the human genome and are based on correlations from a wide population data set. Lee et al. (2018), for instance, presented estimates of a polygenic score which is associated with individual educational attainment in a specific population. Interestingly, several authors recently noticed that several estimates of the same polygenic score might be available, where the weights to aggregate information from individual loci are based on different samples and/or slightly different methodologies. These alternative estimates can then potentially be used to deal with measurement error problems, as in the model discussed above. Relevant contributions on the literature about the identification of measurement systems models are Schennach (2004) and Hu and Schennach (2008).

### A3. THE TANZANIA DATA, NEW MEASURES, AND RESULTS

The study “Improving children’s life chances in high-risk, low-income settings: Designing a “new generation” longitudinal cohort study of child development,” which was approved by the University College London Ethics Committee (2168/013) and the National Institute for Medical Research and the Ministry of Health, Community Development, Gender, Elderly & Children of Tanzania (NIMR/HQ/R.8c/Vol. I/1254), was conducted in several stages (see Figure A1) (see the Tanzania Field Pilot Report Augsburg et al. (2019) for more information). The study sample was randomly chosen to be representative of the total population. The villages were selected from a random sample in the Kagera region. In the selected villages, all households were listed, and from those satisfying the selection criteria, a random sample was drawn.

The Kagera region is located in the northwest corner of Tanzania on the western shore of Lake Victoria. The population is around 3 million people, which is about 5 percent of the national population. It has an intercensal growth rate 2002/2012 of 3.2 (2.7 average for Tanzania) and the double percentage of children age 6–59 months classified as having malaria, according to the Rapid Diagnostic Test in 2017 in terms of country percentage (15.4% vs. 7.3%). The Kagera region is predominantly rural, and agriculture-dependent, producing mainly bananas and coffee in the North and rain-fed annual crops in the South.

During the pilot period, a number of well-known and tested measures were adapted to the local context using multiple techniques (focus group discussions, ethnography study, and pre-pilot in small samples). We used a multi-method approach for the early childhood development (ECD) instruments, combining three main paths: parent/observer report, direct assessment, and observation (through filming and coding).

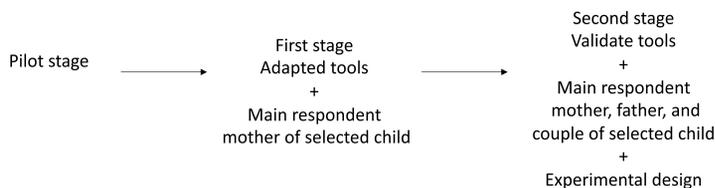


FIGURE A1.—Study design.

After the pilot period, the first stage was implemented in June 2018. Approximately 450 households were recruited across 10 villages. The sample households were randomly selected among those with a child aged between 6 and 36 months and a mother aged between 15 and 25. In this sample, child development was measured using several tools. In addition to standard demographic information about the households involved, the survey also included measures of parental investment.

Information collected during a partial census was used to randomly sample pairs of primary caregivers and children of eligible households from each of the following groups: 150 primary caregivers aged 15–25 years with a child aged 6–11 months, 150 primary caregivers aged 15–25 years with a child aged 12–23 months, and 150 primary caregivers aged 15–25 years with a child aged 24–36 months.

In a second stage, which was implemented in August 2018, an additional 450 households were recruited from the same villages according to the following procedure. First, a random sample of 150 households was selected from a list of 5200 households with children aged 6 to 36 months and mothers aged 15 to 25 years in eight villages. This is what we will refer to as the mothers sample. In addition, a second list of around 2000 households with children aged 6 to 36 months and the fathers present was identified in five different villages.<sup>1</sup> From this list, which also included mothers older than 25, an additional sample of households with fathers present and mothers aged between 15 and 25 years was selected and formed what we label as the couples sample. From the remaining households in the second list, a third sample of 150 households was selected that we label as the fathers sample. Because of the way the second list was formed, the fathers sample comprises couples who are considerably older. Indeed, only 6.6% of the mothers in the sample were younger than 25.<sup>2</sup>

The data collected in the second stage are what we mostly use in this appendix and in Sections 5 and 6. The main goal of the second-stage data collection was to validate some of the child development measures constructed with the factor analysis of first-stage data. However, we also collected a number of new variables aimed at measuring individual tastes, beliefs, and bargaining power within the couple. Each sample's label corresponds to the respondents in this new set of questions. In the mothers sample, for instance, the questions about tastes, subjective beliefs about parental investment returns, and bargaining power were answered by the mother in private; in the couples sample, the taste questions were answered jointly by the couple while the others by the mother in private; in the fathers sample, fathers answered the bargaining power and taste questions in private. All other (standard) modules were answered by the mother.

All data collection followed a rigorous process of tools, instruments, and survey development.<sup>3</sup> Of the 450 pairs recruited for the last stage of the survey, we obtained usable information from 423 households, comprising 145 in the mothers sample, 136 in the fathers sample, and 142 in the couples sample.

The fact that the questions that elicit information on tastes, subjective beliefs about parental investment returns, and bargaining power within the couple are answered by different respondents in the three subsamples makes the survey particularly interesting, as

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<sup>1</sup>The two sets of villages belonged to different wards, the Kashai and the Bakoba. Both wards belonged to the Bukoba municipality in the Kagera region.

<sup>2</sup>In the mothers and couples samples, there are a few mothers older than 25.

<sup>3</sup>All instruments were translated into the local language, Swahili. Translations were carried out by the field staff following a rigorous back-translation procedure. The household surveys were administered in the child's home by enumerators. The adapted version of the assessments of child development were conducted by trained staff in the presence of the primary caregiver.

TABLE A1  
HOUSEHOLD CHARACTERISTICS.

	Mothers Sample		Couples Sample		Adj. <i>p</i> -Value	Fathers Sample		Adj. <i>p</i> -Value
	Mean	Observations	Mean	Observations		Mean	Observations	
<i>Demographics</i>								
Age, M	23.12	145	22.82	142	0.941	30.42	136	0.010
Age, F	28.98	105	28.83	139	1.000	37.05	134	0.010
Secondary school or more, M	0.35	144	0.37	142	1.000	0.23	136	0.079
Secondary school or more, F	0.50	105	0.46	139	0.990	0.34	134	0.059
Food share	0.69	145	0.61	142	0.030	0.63	136	0.079
Wealth index	-0.17	144	-0.04	142	0.931	0.22	136	0.010
<i>Child characteristics</i>								
Child is male	0.57	145	0.54	142	0.990	0.45	136	0.079
Age in months	18.44	145	18.25	142	1.000	18.36	136	0.901
# siblings	0.57	145	0.62	142	0.990	2.16	136	0.010
Birthrank	2.00	145	2.04	142	1.000	3.53	136	0.010

*Note:* The table displays the descriptive statistics for the households. “M” indicates values for mothers and “F” indicates values for fathers. Column (5) compares the mothers and couples samples while column (8) compares the mothers and fathers samples. Columns (5) and (8) report *p*-values adjusted for multiple hypothesis testing using the Romano–Wolf approach. Source: Tz Pilot.

it allows to test the hypothesis that individuals within the family are characterized by differences in these variables. Unfortunately, the recruitment process followed in the field (described above) makes comparisons across different subsamples difficult to interpret. This is particularly true for the fathers sample, which includes considerably older individuals, as we show below. While the fact that the mothers and couples samples were drawn from different villages is not particularly worrying, given the similarities and the proximity of the villages, the systematic difference in the age structure of the study sample makes comparisons across samples problematic.

In Table A1, we report descriptive statistics on the main features of the three samples discussed above. The table also contains *p*-values for tests (adjusted for multiple hypothesis testing) of the difference between the mothers and the fathers samples (in column 5) and the mothers and the couples samples (in column 8). In addition to the new measures (discussed below), information on a standard set of variables, including demographics, education, and wealth markers, was also collected in the three samples.

Consistent with the sampling scheme, the mothers and couples samples have relatively younger mothers, with an average age of 22, while in the fathers sample, the average mother’s age is about 7 years higher. This difference is also reflected in the average father’s age in the fathers sample (between 5 and 7 years higher than in the mothers and couples samples). About 20% of the mothers sample is made of single mothers (i.e., the child’s father is not present). The average child’s age is uniform across the three samples and the share of male children is lowest in the fathers sample.

The only significant and somewhat surprising difference between the mothers and couples samples is the share of total expenditure spent on food, which could be considered

TABLE A2  
WILLINGNESS TO PAY (OUT OF 6600 TSH).

	Wives Mothers and Couples Samples	Husbands Fathers Sample
Average share	0.320	0.100
Median share	0.061	0.008
Std. Dev.	0.395	0.258
Observations	218	98

*Note:* The table displays the descriptive statistics for the Willingness To Pay (WTP) variable, which is measured as the share of 6600 TSH that the respondents (i.e., wives in the mothers and couples samples, and husbands in the fathers sample) were willing to forfeit to have the payment made to them rather than their spouse. In the mothers sample, only households where the father is present are included. Source: Tz Pilot.

a useful indicator of economic well-being.<sup>4</sup> This variable is higher in the mothers sample, at 0.69, indicating a poorer sample, and lowest in the couples sample, at 0.61.

We also observe a number of wealth indicators, which we use to estimate a wealth index, normalized to have zero mean in the whole sample. Consistent with the evidence on the food share, the wealth index is lowest in the mothers sample. These differences in permanent income and wealth, however, are not consistent with the information on education: both mothers and fathers in the fathers sample are the least educated, while the mothers sample is the most educated. These differences might reflect cohort effects.

### A3.1. Bargaining Power

In Table A2, we report the average share of the 6600 TSH that the respondents (i.e., the wives in the mothers and couples samples and the husbands in the fathers sample) were willing to forfeit so that the payment would be made to them rather than their spouse.

Using the answers to these questions in the mothers and couples samples (where the wife is the respondent) and the fathers sample (where the husband is the respondent), we estimate a measurement system and, from that, the latent factor of interest, reflecting women's decision power in the couple. The estimates of the measurement system parameters are reported in Table A3.

In particular, in Table A4, we report the results of a regression of the WTP on the latent factor reflecting decision making power, estimated first for the sample of mothers and couples and then for the sample of fathers.

### A3.2. Beliefs on Returns to Parental Investment

In the Tanzania sample, we elicit beliefs about different aspects of the developmental process and the importance of certain parental inputs. In addition to beliefs about cognitive development, we also measure beliefs about the effect of parenting on socio-emotional development, a type of belief that has not been measured before.

In Figure A2, we plot the distribution of expected returns under low and high initial conditions for the whole sample as well as for the mothers and fathers subsamples. In Figure A3, we report the distributions of expected returns from different initial values

<sup>4</sup>The intuition for this goes back to the established economic regularity that the food share falls with income (Engel (1857, 1895)). Food shares have been used to identify differences in real income and well-being (Hamilton (2001), Costa (2000), Almås (2012b), Almås and Johnsen (2018)).

TABLE A3  
MEASUREMENT SYSTEM FOR DECISION MAKING.

	Decision Making			
	Wives Mothers and Couples Sample		Husbands Fathers Sample	
	$\beta$	$\alpha$	$\beta$	$\alpha$
Own health	1.000	0.000	1.000	0.000
Children’s health	1.282 (0.263)	-0.172 (0.168)	1.213 (0.484)	-1.140 (0.249)
Children’s schooling	1.202 (0.380)	-1.254 (0.183)	1.021 (0.419)	-0.680 (0.194)
Household purchases	0.693 (0.217)	-0.969 (0.132)	1.506 (0.638)	-0.386 (0.242)
Cooking	0.269 (0.116)	0.906 (0.114)	0.563 (0.296)	-1.039 (0.167)
Visiting	0.630 (0.186)	-0.933 (0.127)	0.582 (0.302)	0.235 (0.138)
Factor mean	0.458		-0.217	
Factor variance	0.926		0.402	

Note: This table shows the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) of an IRT estimated from questions about who is mainly responsible for a number of decisions within the household, including: major household expenditures, children’s education, own and children’s health expenditures, what food to cook, and whether the wife can go out. Columns (1) and (2) are for the mothers and couples sample, and columns (3) and (4) for the fathers sample. In the mothers sample, only households where the father is present are included. Standard errors in parentheses. Source: Tz Pilot.

TABLE A4  
WILLINGNESS TO PAY AND DECISION MAKING FACTORS.

	Willingness to Pay	
	Wives Mothers and Couples Samples	Husbands Fathers Sample
Decision making factor	-0.081 (0.032)	0.071 (0.054)
Couple	-0.042 (0.054)	
R-squared	0.033	0.018
Observations	218	98

Note: The table displays regressions of the willingness to pay on the decision making variable and a dummy for the couple treatment arm of the experiment. In the mothers sample, only households where the father is present are included. Standard errors in parentheses. Source: Tz Pilot.

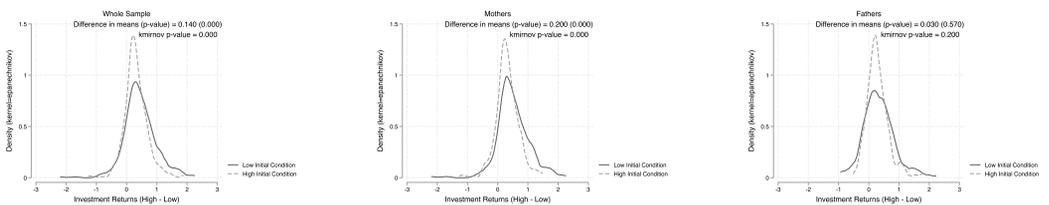


FIGURE A2.—Beliefs on language development: returns to parental investment.

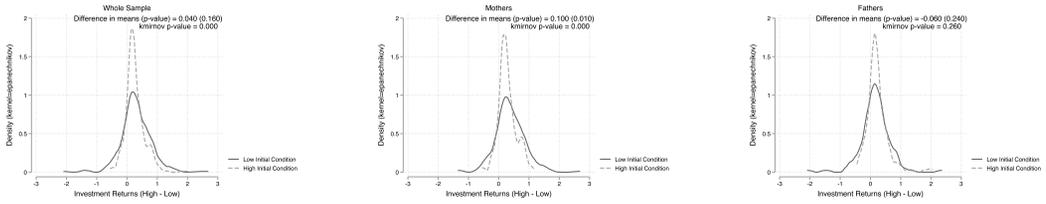


FIGURE A3.—Beliefs on socio-emotional development: returns to parental investment.

in the whole sample and, as for beliefs about language development, for the mothers and fathers samples separately. As in Figure A2, we report KS tests for the difference between the two distributions and a test for the difference between the low and high initial conditions distributions.

The results are similar to those of beliefs about the effect of parenting on cognitive development and language. In the whole sample, returns to parental investment in socio-emotional development are perceived to be higher for low than for high initial conditions: the difference in means for the whole sample is equal to 0.044 ( $p$ -value = 0.158). This effect comes from mothers, where the difference is equal to 0.098 ( $p$ -value = 0.007). We see no such effect for the fathers sample, where the difference in means is equal to  $-0.063$  ( $p$ -value = 0.241).

Table A5 reports the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) of the returns to parental investment on language and socio-emotional skills elicited in our survey.

### A3.3. Measuring Preferences

In Table A6, we report the share of the total additional resources allocated to each individual in the family (spouse, child, and self) for each of the three samples.

In Table A7, we report the shares allocated, for each sample, to the six different commodities. Table A8 shows the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) for each ratio of the resources allocated to each spouse for four adult commodities (food, clothing, health, and transportation) from the allocation questions.

### A3.4. Parental Investment

In terms of the measure of parental investment, we use multiple sources of information:

*Expenditures for Children.* Reported spending on children’s health, clothing, shoes, toys, education, books, and bedding.

*Material Investments.* Reported frequency of acquiring the following products for their child: food, clothing, footwear, confectioneries, medicine and oral rehydration salts, mosquito net, books, toys, and learning materials (notebooks, pens, and pencils).

*Play Material.* The number of toys the child has, made at home or bought, music instruments, books, and drawing equipment.

*Adult Activities With Children.* Reading books, singing, playing, and cooking with the child.

TABLE A5  
MEASUREMENT SYSTEM FOR BELIEFS.

	A Measurement System for Beliefs					
	Couples Sample		Mothers Sample		Fathers Sample	
	$\beta$	$\alpha$	$\beta$	$\alpha$	$\beta$	$\alpha$
Language hard	1.000	0.000	1.000	0.000	1.000	0.000
High Dev.	-	-	-	-	-	-
Language hard	2.098	-0.023	1.220	0.024	1.314	-0.042
Low Dev.	(0.514)	(0.201)	(0.257)	(0.124)	(0.243)	(0.114)
Language medium	0.868	0.040	0.573	0.095	1.015	-0.090
High Dev.	(0.175)	(0.074)	(0.136)	(0.066)	(0.138)	(0.065)
Language medium	1.628	0.009	0.556	0.255	1.039	-0.066
Low Dev.	(0.430)	(0.166)	(0.172)	(0.082)	(0.173)	(0.081)
Language easy	0.746	0.065	0.057	0.296	0.877	-0.008
High Dev.	(0.180)	(0.075)	(0.091)	(0.043)	(0.125)	(0.058)
Language easy	1.082	0.167	-0.181	0.556	1.062	-0.075
Low Dev.	(0.307)	(0.122)	(0.137)	(0.065)	(0.179)	(0.083)
Socio-emotional Nine	0.332	0.156	0.566	0.216	0.965	-0.081
High Dev.	(0.161)	(0.067)	(0.128)	(0.060)	(0.169)	(0.076)
Socio-emotional Nine	0.397	0.259	1.420	0.072	1.168	-0.206
Low Dev.	(0.317)	(0.133)	(0.238)	(0.106)	(0.199)	(0.090)
Socio-emotional Five	0.362	0.128	0.379	0.190	0.819	-0.068
High Dev.	(0.131)	(0.055)	(0.088)	(0.041)	(0.135)	(0.060)
Socio-emotional Five	0.024	0.352	0.964	0.118	0.928	-0.182
Low Dev.	(0.240)	(0.100)	(0.172)	(0.078)	(0.170)	(0.077)
Socio-emotional Three	0.425	0.075	0.118	0.191	0.589	0.003
High Dev.	(0.145)	(0.061)	(0.065)	(0.031)	(0.118)	(0.053)
Socio-emotional Three	-0.180	0.374	0.368	0.168	0.702	-0.098
Low Dev.	(0.202)	(0.084)	(0.117)	(0.055)	(0.170)	(0.078)
Factor mean	0.346		0.303		0.348	
Factor variance	0.069		0.151		0.109	

Note: This table shows the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) for each returns to parental investment on language and socio-emotional skills elicited in our survey which are estimated through a measurement system model. Columns (1) and (2) are for the couples sample, columns (3) and (4) for the mothers sample, and columns (5) and (6) for the fathers sample. Standard errors in parentheses. Source: Tz Pilot.

TABLE A6  
AVERAGE SHARE OF EXPENDITURE ALLOCATED TO HOUSEHOLD MEMBERS.

	Mother Decision (s.e.)	Father Decision (s.e.)	Diff ( <i>p</i> -Value)	Couple Decision (s.e.)	Diff ( <i>p</i> -Value)
To self	0.268 (0.008)	0.257 (0.007)	-0.01 (0.348)	0.250 (0.009)	-0.02 (0.148)
To spouse	0.175 (0.009)	0.219 (0.007)	0.04 (0.000)	0.232 (0.009)	0.06 (0.000)
To child	0.558 (0.011)	0.524 (0.013)	-0.03 (0.043)	0.518 (0.013)	-0.04 (0.019)

Note: This table shows the average share of expenditure to household members for the different samples. Standard errors are in parentheses. The *p*-values refer to the test of the difference between the mothers and fathers samples and the mothers and couples samples. Source: Tz Pilot.

TABLE A7  
ALLOCATION TO THE CHILD.

	Mother Decision (s.e.)	Father Decision (s.e.)	Diff ( <i>p</i> -Value)	Couple Decision (s.e.)	Diff ( <i>p</i> -Value)
Clothing	6.628 (0.225)	5.559 (0.311)	-1.07 (0.005)	5.493 (0.195)	-1.13 (0.000)
Food	6.062 (0.302)	5.338 (0.269)	-0.72 (0.076)	4.401 (0.251)	-1.66 (0.000)
School exp.	7.434 (0.353)	7.529 (0.573)	0.09 (0.886)	7.282 (0.456)	-0.15 (0.791)
Learning mat.	5.503 (0.247)	5.213 (0.285)	-0.29 (0.441)	5.697 (0.317)	0.19 (0.629)
Health exp.	5.159 (0.207)	5.213 (0.252)	0.05 (0.866)	5.761 (0.232)	0.60 (0.054)
Transportation	2.683 (0.182)	2.603 (0.202)	-0.08 (0.769)	2.430 (0.199)	-0.25 (0.349)

*Note:* This table shows the descriptive statistics of allocation of expenditure on children. Standard errors are in parentheses. The *p*-values refer to the test of the difference between the mothers and fathers samples and the mothers and couples samples. Source: Tz Pilot.

*Didactic Scale.* From the Parental Style Questionnaire (PSQ): whether the primary caregiver (i) spends time playing with the child, (ii) provides the child with independent time to explore and learn on his/her own, (iii) provides the child with diverse social and

TABLE A8  
MEASUREMENT SYSTEM FOR RELATIVE TASTE FOR CHILD HUMAN CAPITAL.

	Relative Taste for Child Human Capital					
	Couples Sample		Mothers Sample		Fathers Sample	
	$\beta$	$\alpha$	$\beta$	$\alpha$	$\beta$	$\alpha$
Mother's clothing ratio	1.000	0.000	1.000	0.000	1.000	0.000
Father's clothing ratio	1.009 (0.058)	-0.021 (0.013)	0.936 (0.190)	-0.039 (0.033)	0.729 (0.165)	0.007 (0.023)
Mother's food ratio	0.850 (0.172)	0.043 (0.038)	4.294 (0.649)	-0.527 (0.111)	1.472 (0.295)	-0.031 (0.041)
Father's food ratio	0.850 (0.150)	0.001 (0.032)	-0.011 (0.179)	0.111 (0.031)	1.229 (0.252)	-0.023 (0.036)
Mother's health ratio	0.540 (0.065)	0.043 (0.014)	-0.028 (0.106)	0.115 (0.018)	1.410 (0.294)	-0.057 (0.041)
Father's health ratio	0.530 (0.060)	0.030 (0.012)	-0.005 (0.116)	0.078 (0.020)	0.795 (0.189)	-0.006 (0.027)
Mother's transportation ratio	0.540 (0.065)	0.043 (0.014)	-0.028 (0.106)	0.115 (0.018)	1.410 (0.294)	-0.057 (0.041)
Father's transportation ratio	0.530 (0.060)	0.030 (0.012)	-0.005 (0.116)	0.078 (0.020)	0.795 (0.189)	-0.006 (0.027)
Factor mean (variance)	0.175	(0.020)	0.162	(0.004)	0.135	(0.002)

*Note:* This table shows the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) for each ratio of the resources allocated to each spouse for four adult commodities (food, clothing, health, and transportation) from the allocation questions which are estimated through a measurement system model. Standard errors in parentheses. Columns (1) and (2) are for the couples sample, columns (3) and (4) for the mothers sample, and columns (5) and (6) for the fathers sample. Source: Tz Pilot.

TABLE A9  
PARENTAL INVESTMENT COMPONENTS.

	Couples Sample	
	Mean	Observations
<i>Parental Investment</i>		
Raw Activity Score (/26)	14.89	142
Raw Material Investment Score (/12)	5.23	142
Raw Play Material Score (/8)	1.51	142
Social scale (/5)	4.28	142
Didactic scale (/8)	4.94	142
Expenditure on children share	0.32	142
Total Parental Investment (factor)	-0.38	142

*Note:* Mean and number of observations for markers of parental investment for the couples sample. In parentheses, the maximum value of each marker of parental investment. Source: Tz Pilot.

interactive experience with same-age peers through play groups or informal get-together, (iv) provides the child with a structured, organized, and predictable environment, (v) provides language learning opportunities for the child by labeling and describing qualities of objects, events, or activities, reading books etc., (vi) provides the child with a variety of toys and objects for play and exploration, (vii) is patient with the child's misbehavior, and (viii) is flexible about behaviors expected from the child.

*Social Scale.* The social scale from the PSQ accounts for whether the primary caregiver (i) promptly and appropriately responds to the child's expressed distress or discomfort, (ii) spends time talking to or conversing with child, (iii) provides child with quick and positive feedback to his/her bid for attention, (iv) provides child with affectionate displays of warmth and attention, and (iv) is aware of what child wants or feels.

TABLE A10  
A MEASUREMENT SYSTEM FOR PARENTAL INVESTMENT.

	Couples Sample	
	$\beta$	$\alpha$
Parental Activities	1.000	0.000
Play Material	0.362 (0.136)	-0.201 (0.086)
Material Investment	1.007 (0.377)	0.201 (0.176)
Expenditure on children share	0.351 (0.128)	-0.080 (0.070)
Social scale	0.657 (0.329)	0.181 (0.173)
Didactic scale	0.415 (0.235)	0.031 (0.136)
Factor mean (variance)	-0.376	(0.436)

*Note:* This table shows the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) for markers of parental investment. Columns (1) and (2) are for the couples sample. Standard errors in parentheses. Source: Tz Pilot.

TABLE A11  
MODELING EXPENDITURE: COUPLES SAMPLE.

	(1) Exp Share	(2) Exp Share	(3) Exp Share	(4) Exp Share	(5) Exp Share
Log of total expenditure	−0.097 (0.030)	−0.095 (0.030)	−0.081 (0.027)	−0.081 (0.027)	−0.079 (0.027)
Relative taste for child human capital (RC)		−0.143 (0.202)	−0.136 (0.179)	−0.146 (0.330)	0.146 (0.421)
Beliefs		−0.019 (0.131)	0.036 (0.121)	0.031 (0.198)	0.041 (0.122)
Bargaining power (BP)			−0.009 (0.063)	−0.009 (0.064)	0.054 (0.105)
Beliefs * RC				0.039 (1.117)	
BP * RC					−0.362 (0.487)
R-squared	0.143	0.146	0.208	0.208	0.212
Observations	142	142	126	126	126

Note: The table displays regressions using the factor of expenditures share as a left-hand-side variable and the following right-hand-side variables: (i) Log of total expenditure is the logarithm of total household expenditure from the household survey; (ii) Bargaining power is a measure of female bargaining power, and more precisely, it is 1 minus the share that the woman is willing to pay to gain control over a fixed amount of money from our experiment; (iii) Relative taste for child human capital is a factor of ratios of the resources allocated to each spouse for four adult commodities to the resources allocated to the child in our allocation experiment; and (iv) Beliefs is a factor of the returns to parental investment on language and socio-emotional skills elicited in our survey. All models are controlled by child and mothers characteristics: child's age and gender, number of siblings in the household, dummy for mother's secondary education, and mother's cognition skills measured by the Raven's test. Standard errors in parentheses. Source: Tz Pilot.

Table A9 reports descriptive statistics on the parental investment components and Table A10 shows the loading factors ( $\beta$ ) and the intercept ( $\alpha$ ) for markers of parental investment.

In Table A11, we report the results of regressing traditional measures of parental investment on log total expenditure as well as on beliefs and taste factors (and their interactions) and our measure of bargaining power.

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*Co-editor Oriana Bandiera handled this manuscript, which is based on a Presidential Address.*

*Manuscript received 18 January, 2023; final version accepted 9 February, 2024; available online 1 May, 2024.*