ISER Working Paper Series

Maternal Investments in Children: The Role of Expected Effort and Returns

Sonia Bhalotra
University of Essex

Adeline Delavande
University of Technology Sydney

Paulino Font Gilabert
University of Essex

Joanna Maselko
University of North Carolina

No. 2020-3
March 2020

INSTITUTE FOR SOCIAL
& ECONOMIC RESEARCH

Economic and Social Research Council

University of Essex

www.iser.essex.ac.uk

Non-Technical Summary

Summary: Inequalities in child developmental outcomes emerge early in life and persist. Parental investments play a critical role in determining early life differences. We gathered primary longitudinal data to investigate the importance of subjective expectations of returns to and effort costs of the two main investments that mothers make in newborns: breastfeeding and stimulation. We find differences across mothers in expected effort costs and expected returns for outcomes in the cognitive, socio-emotional and health domains, and we show that this contributes to explaining differences in investments. We find no significant differences in preferences for child developmental outcomes. We simulate the impact of a series of alternative policy measures on mother's investment choices, and our findings highlight the relevance of interventions designed to reduce perinatal fatigue alongside interventions that increase perceived returns to investments.

Elaboration: Gaps in children's intellectual, physical, and emotional development by family-level deprivation emerge early in childhood and tend to widen over time. It is estimated that at least half of the variation across individuals in lifetime earnings arises from attributes determined by age 18. Early childhood developmental outcomes are shaped by a combination of neurological, physiological, and environmental factors, including nutrition, stress, and the responsivity and stimulation offered by parents and other caregivers. Parents thus play a crucial role and differences in parental behaviours must be an important facet of the emergence of unequal capabilities in children.

In the commonly used analytical framework, differences in parental investments arise either from differences in financial constraints or from differences in parental preferences over child development. As it can be difficult to modify preferences, this has led to a tradition of seeking to ameliorate childhood inequalities through cash transfers. However, the evidence that untargeted income transfers to poor families boost child outcomes is ambiguous. This makes it important to consider whether there are sources of constraints on parental investments in children.

Our research highlights the relevance of two additional constraints. First, we show that parents often have limited or biased information about how important it is for their child's development that they breastfeed or play with the child. Second, we show that making investments in young children incurs effort (not just money but time and energy) and, as a result, mothers who suffer postnatal fatigue because of depression or poverty may be less likely to invest in their newborn child.

We interviewed 1,100 pregnant women in rural and peri-urban Pakistan, asking them how tiring they expect that breastfeeding and playing will be after their child is born, and also asking what

they think the chances are that the child will do better in various developmental domains if they breastfeed or play with the child. The domains we ask about include the cognitive (language and learning well at school), socio-emotional (playing with other children) and health (diarrhea, the leading cause of death among infants and children in Pakistan) domains.

In general, mothers report positive expected returns to maternal investments. They expect exclusive breastfeeding to have its highest impact on children's health (with, on average, a 39 pp expected reduction in the likelihood that the child will experience diarrhea), while they expect play to have its highest impact on cognition (with, on average, an increase of 35 pp in the expectation that the child will learn well at school). There is, however, substantial variation in expected returns. Expected costs also vary across mothers, with around 39% of them reporting that they expect to find breastfeeding to be tiring, and 35% saying they expect that playing with the child will be tiring. More educated and more wealthy women are more likely to expect higher returns and lower effort costs. We also find that women who are depressed in pregnancy expect investing in their child to be more tiring.

Using the data to estimate a model of the mother's decision making over whether to breastfeed and play, we find that both expected returns and expected effort costs contribute to determining how much women invest but, at least in this sample of poor women, there are no significant differences in how much they value child developmental outcomes. Using simulation techniques we find that an information policy that increases mothers' expected returns raises both investments. Information interventions are inexpensive relative to resource interventions (like cash transfers or school construction), and issues of parental responses such as crowd-out do not arise. In a departure from previous research, we also demonstrate, for the case of play, that eliminating effort costs leads to a significant increase in stimulation. Increasing expected returns while at the same time lifting effort cost (for instance by treating maternal depression or facilitating mother networks such as playgroups) shows the strongest potential to foster maternal investments.

Maternal Investments in Children:

The Role of Expected Effort and Returns

Sonia Bhalotra
University of Essex

Adeline Delavande
University of Technology Sydney

Paulino Font Gilabert
University of Essex

Joanna Maselko
University of North Carolina

March 4th, 2020

Abstract

We investigate the importance of subjective expectations of returns to and effort costs of the two main investments that mothers make in newborns: breastfeeding and stimulation. We find heterogeneity across mothers in expected effort costs and expected returns for outcomes in the cognitive, socio-emotional and health domains, and we show that this contributes to explaining heterogeneity in investments. We find no significant heterogeneity in preferences for child developmental outcomes. We simulate the impact of various policies on investments. Our findings highlight the relevance of interventions designed to reduce perinatal fatigue alongside interventions that increase perceived returns to investments.

E-mail: srbhal@essex.ac.uk (Bhalotra); Corresponding author: adeline.delavande@uts.edu.au (Delavande); pfontg@essex.ac.uk (Font-Gilabert); jmaselko@email.unc.edu (Maselko)

We acknowledge funding from the US National Institute of Health (NICHD, R01 HD075875). Delavande and Bhalotra also acknowledge funding from the Economic and Social Research Council Research Centre on Micro-Social Change (ES/L009153/1 and ES/S012486/1).

1. Introduction

Gaps in children's intellectual, physical, and emotional development by family-level deprivation emerge early in childhood and tend to widen over time (World Bank, 2015; Ermisch et al., 2012; Cunha et al., 2006). It is estimated that at least half of the variation across individuals in lifetime earnings arises from attributes determined by age 18 (Cunha et al., 2005; Huggett et al., 2011; Keane and Wolpin, 1997). Early childhood developmental outcomes are shaped by a combination of neurological, physiological, and environmental factors, including nutrition, stress, and the responsivity and stimulation offered by parents and other caregivers. Parents thus play a crucial role and differences in parental behaviours must be an important facet of the emergence of unequal capabilities in children.

In the model of parental investments pioneered by Becker and Tomes (1979, 1986), heterogeneity in parental investments arises either from differences in resource constraints or from differences in parental preferences over child development. As it can be difficult to modify preferences, this has led to a tradition of seeking to ameliorate childhood inequalities through cash transfers. However, the evidence that untargeted income transfers to poor families boost child outcomes is ambiguous (Heckman and Mosso, 2014; Caucutt and Lochner, 2020).

We contribute to recent research highlighting the potential relevance of two additional constraints on parental investments- information frictions and effort costs. The Beckerian model assumes that parents have perfect information on how their investments influence child outcomes (henceforth, *expected returns*). As in Cunha et al. (2013), we relax this assumption, allowing that parents with similar preferences and resource constraints may choose different levels of investment in their children because they have different subjective expectations (or beliefs) of the returns. If this is the case, interventions that offer information to mothers may redress early gaps in development. However, even if mothers update their beliefs about returns to their investments in children, effort costs may constrain investment. Effort costs may arise, for instance, from postnatal fatigue, depression or the cognitive load associated with poverty (Mullainathan and Shafir, 2013; Putnam, 2015), and failing to address these constraints may limit the effectiveness of a range of early childhood interventions. In an important contribution to the literature, we model effort cost directly, addressing a second limitation of traditional models of parental investments which interpret resource constraints as credit constraints, neglecting the relevance of mental and physical capacity.

To investigate the role of information and effort costs, we elicit baseline data on expected returns and effort costs from a sample of more than 1,100 pregnant women in rural and peri-urban Pakistan and measure investments when their children are three months old. In

particular, we elicit probabilistic beliefs about investment returns in terms of child development in various domains: cognitive (language and learning well at school), socio-emotional (playing with other children) and health (diarrhea, the leading cause of death among infants and children in Pakistan). We use visual aids following the approach developed by Delavande and Kohler (2009) and reviewed in Delavande (2014). We elicit expected effort costs by asking mothers how tiring they anticipate the activities of breastfeeding and play to be. We focus on exclusive breastfeeding and guided play as these are essential aspects of parenting and attachment-creation in the first months of life. Moreover, parenting and attachment have been argued to be among the most critical family-level factors influencing human capital and social mobility (Heckman and Mosso, 2014).[1]

The expectations and cost data we elicit are well-behaved. For example, the vast majority of respondents respect the basic properties of probabilities when answering the questions. In general, mothers report positive expected returns to maternal investments. They expect exclusive breastfeeding to have its highest impact on children's health (with, on average, a 39 pp expected reduction in the likelihood that the child will experience diarrhea), while they expect guided play to have its highest impact on cognition (with, on average, an increase of 35 pp in the expectation that the child will learn well at school). There is, however, substantial variation in expected returns. Expected costs also vary across mothers, with around 39% of them reporting that they expect to find breastfeeding to be tiring, and 35% saying they expect that playing with the child will be tiring. Heterogeneity in both expected returns and effort costs exhibits a gradient in socioeconomic status (measured by education and wealth). We also find that expected effort costs for both investments are higher among women who are depressed in pregnancy, but we find no significant association of depression with expected returns.

We use the data on investments as well as the expected returns and costs measured before any investment is made, to estimate preference parameters for child developmental outcomes and effort costs using a discrete choice model in which mothers decide whether to breastfeed and play. Our main finding is that differences across mothers in expected returns and expected effort costs contribute to differences in maternal investments, but that differences in preferences for child developmental outcomes play a limited role. Learning well at school appears to be the most important development outcome determining early childhood

[1] Fitzsimons and Vera-Hernandez (2013) identify a positive causal impact of breastfeeding on cognitive development, and several other studies have associated breastfeeding with attachment (e.g. Britton et al., 2006). Attanasio et al. (2020) identify impacts of structured play on cognitive development among toddlers.

investment.[2] The estimated elasticities with respect to returns are about 4 to 5 times larger than in studies investigating the elasticities of education choices with respect to expected earnings (Arcidiacono, 2004; Wiswall and Zafar, 2015; Delavande and Zafar, 2019). There are no previous estimates of the elasticity of maternal investment with respect to perceived costs.

We use the structural parameters to simulate the impact of alternative policies that raise expected returns or lift effort costs. In line with previous research, we find that an information policy that increases mothers' expected returns raises both investments. Information interventions are inexpensive relative to resource interventions (like cash transfers or school construction), and issues of parental responses such as crowd-out do not arise. In a departure from previous research, we also demonstrate, for the case of guided play, that eliminating effort costs leads to a significant increase in stimulation. Investment in play increases by 12% (3.8pp from a baseline of 31%) in a simulation in which effort costs are set to zero- a magnitude that happens to be the same as that which results from raising expected returns by the interquartile range of the returns distribution. Increasing expected returns while at the same time lifting effort cost shows the strongest potential to foster maternal investments, with a large increase in play of 25% under the scenarios specified above.[3] In an alternative simulation, we investigate the effect of treating depression by setting an indicator for whether the mother is depressed to zero, and replacing the expected returns and costs reported by depressed mothers with the averages from the non-depressed sample. This results in an increase in investment in play of 8%, consistent with our finding that depression exacerbates effort costs.[4] Our results indicate a potential role for information policies as well as interventions that act to lighten the mental and physical load on new mothers, such as mothers groups or depression treatments, as a way to foster child development.

Following recognition of the identification problem that arises because many combinations of preferences and expectations yield the same choice (Savage 1954, Manski 2004, Delavande 2008), a number of recent studies combine expectations data with choice data to better understand forward-looking decisions (see Delavande, 2008; Attanasio and Kaufmann

[2] At baseline we also elicit preferences by asking women how much they care about each development outcome that we analyse. A larger fraction of women say they care about the child learning well at school than for the other developmental outcomes. When we estimate our model with all developmental outcomes together, then learning wins the horse race.

[3] This combined intervention is also effective at reducing differences in investment across mothers with high vs low ends education and wealth and the difference between mothers who were and were not depressed in pregnancy.

[4] The data show that mothers who are depressed in pregnancy are 9.7 and 8 percentage points more likely to say that they expect breastfeeding and playing with their child will be tiring. In line with this, the data also show that women who are depressed in pregnancy are less likely to make both investments at 3 months.

2014; Delavande and Kohler, 2016; Stinebrickner and Stinebrickner, 2012, 2014a,b; Giustinelli, 2016; Wiswall and Zafar, 2018; Arcidiacono et al. 2012; Delavande and Zafar, 2019).[5] With some recent exceptions discussed next, this research has not studied the role of parental expectations in determining parental investment in children. Dizon-Ross (2019) differs from us in eliciting parental beliefs about the child's academic performance and providing information on actual school grades rather than on expected returns to investing in children. Cunha et al. (2013, 2019), Boneva and Rauh (2018), Attanasio et al. (2018) and Attanasio et al. (2019) are similar to us in eliciting beliefs about returns to parental investments but, in contrast to us, they do not elicit effort costs. Our approach also differs from these studies in eliciting perceived returns in the health, cognitive and socio-emotional domains. With the exception of Biroli et al. (2018) who investigate parental beliefs about the returns to diet and exercise among children age 5-18 in the UK, related studies have focused on cognitive, education or earnings returns.

Although to our knowledge the effort costs of mothers in making early postnatal investments have not been directly measured or incorporated before in models of maternal investments, a number of recent papers show that non-pecuniary factors or psychic costs influence (own) education decisions (Cunha et al., 2005; Eisenhauer et al., 2015; Navarro and Zhou, 2016; Delavande and Zafar, 2019; Boneva and Rauh, 2019). From a methodological perspective, if expected returns and effort costs are correlated, then omitting costs in the choice model will tend to bias estimates of the importance of preferences (see also the discussion in Wiswall and Zafar, 2015). From a substantive perspective, non-pecuniary costs for maternal investments, which include physical and mental constraints, may render simple tasks such as breastfeeding or interacting with a child burdensome. Physically, it can take a mother a year or more to recuperate from pregnancy and replenish stocks of vital nutrients (DaVanzo and Pebley, 1993). Mental constraints may arise from perinatal depression, which is estimated to affect 10 percent of women in high-income countries and 20 percent in low- and middle-income countries. The condition often goes undiagnosed and hence untreated (Gelaye et al., 2016), and is associated with stress and fatigue (Cohen et al., 1982; Den Hartog et al., 2003). Effort costs may similarly be elevated on account of the burdens of poverty. Recent work shows that the stress of poverty can enhance cognitive load and trigger tunnelling in decision-making (Mani et al., 2013; Schilbach et al., 2016).

[5] An alternative approach to the direct use of expectations data is to rely on stated choices for multiple hypothetical scenarios as in Adams and Andrew (2019). This approach delivers the population average of beliefs vs preferences by comparing parent responses to certain vs uncertain choices. It is therefore not appropriate when one wants individual-specific expectations to associate them with choices.

Our study is one of the few to analyse the role of maternal subjective expectations of returns and costs in the context of child development in a developing country.[6] There is an ongoing global learning crisis affecting the developing world as well as poor families in developed countries, with an estimated 39 percent of the world's children under age five failing to attain their cognitive potential (e.g., Grantham-McGregor et al. 2007, UNESCO 2014). In line with the finding that parental beliefs about the returns to investment are downward biased among parents of low socioeconomic status (Cunha et al., 2013) , it seems plausible that returns are underestimated in many developing countries (Attanasio et al., 2019). Similarly, perceived costs are likely to be higher in low income settings where constraints on time and energy are tighter. For these reasons, the returns to interventions that lead people to update beliefs on returns, or that reduce effort costs, are likely to be higher in developing countries.

Our finding that maternal depression elevates the perceived costs of play with the infant child contributes to an emerging literature on depression and economic decision-making. In the US and Pakistani context respectively, Ronda (2016) and Baranov et al. (forthcoming) find that depression hinders maternal investments. Both studies suggest that effort cost may be important but cannot test for this directly due to lack of data on this cost. DeQuidt and Haushofer (2018) formulate a theoretical model in which depression leads to an individual having downward biased beliefs about returns to their effort (i.e. their productivity), as a result of which they supply less effort. As far as we know, their hypothesis has not been tested- we provide the first empirical test of an association of expected returns with depression. Our findings tie in with their overall conclusion that depression can lead to lower investments but, for the case of maternal investments in children, our evidence is not consistent with depression biasing beliefs downward but, rather, with depression elevating perceived effort costs.

The rest of this paper unfolds as follows. Section 2 introduces our model of early life investments. Section 3 describes our data collection framework and our measures of maternal beliefs, costs, and investments. Section 4 provides descriptive evidence on the different variables feeding the model, and Section 5 specifies the empirical model and reviews the estimates. Section 6 carries out a series of robustness checks to assess the sensitivity of the assumptions and specifications. Section 7 provides results from policy simulations targeting an increase in maternal investments in early-life. Finally, section 8 offers some concluding remarks.

2. A simple static model of early-life maternal investments

[6] Attanasio et al. (2019) elicit subjective expectations in Colombia.

Here we set out a simple model of maternal investments that motivates the data collection and empirical analysis. Consider a mother *i* who has recently given birth to a child. For simplicity, we assume here that the newborn is the only (first) child in the household but we relax this assumption in the estimation. The mother's utility depends on household consumption c_i, and on three dimensions of her child's human capital in early (preschool) childhood (health h_i, cognitive ability a_i, and socio-emotional development s_i) as well as one dimension of development during later childhood (learning well at school l_i). The mother can engage in two different binary investments in the preschool period, breastfeeding e_{i1} and stimulating her child through play e_{i2}. These investments may impose an effort or psychic cost on the mother and produce a return in terms of the child's development. Since we measure investments at a very young age (3 months) in a low income setting with virtually no female labor force participation, we abstract from monetary investments. For tractability, we assume that the utility function is additively separable, and logarithmic in consumption.

The mother's utility is given by:

$$U_i(\mathrm{c}_i, h_i, a_i, s_i, e_{i1}, l_i, e_{i2}) = \alpha \ln(\mathrm{c}_i) + u_{hi}(h_i) + u_{ai}(a_i) + u_{si}(s_i) + u_{si}(l_i) - \mathrm{C}(e_{i1}, e_{i2}) + \varepsilon_{ei},$$

where α is the utility value of log consumption, $u_{ji}(j)$ is the utility associated with the child's human capital outcome j $(j \in \{h_i, a_i, s_i, l_i\})$, $\mathrm{C}(e_{i1}, e_{i2})$ is the effort cost of engaging in the different investments (e_{i1}, e_{i2}), which we will simply call cost from now on, and ε_{ei} is a random term which is individual and investment specific, and unobservable to the econometrician. To reflect the scarcity of well-functioning credit markets in rural Pakistan, we assume there is no borrowing or lending so that mothers will consume their household earnings w_i.

A key feature of the model is that mothers face uncertainty about the child's future human capital outcomes at the time of choosing the investment levels as well as about the actual cost they will incur.[7] Although each combination of investment levels (e_{i1}, e_{i2}) is associated with an objective probability for the realization of the developmental outcomes (i.e. there is a technology of skills production), the individual mother possesses subjective beliefs $\mathrm{P}_i(j|e_{i1}, e_{i2})$ about the realization of a child's human capital outcome j $(j \in \{h_i, a_i, s_i, l_i\})$ when engaging in (e_{i1}, e_{i2}) and, similarly, expectations about the cost she will incur $E_i[C(e_{i1}, e_{i2})]$. The mother's problem is therefore to choose investment levels (e_{i1}, e_{i2}) that maximize her subjective

[7] For instance, breastfeeding or guided play may take a longer or shorter time than anticipated, they may be demanded by the child at unexpected times (that elevate the cost of providing them), and they may cause more or less fatigue or stress depending on the day.

expected utility:

$$\mathrm{E}U_i(\mathrm{w}_i, P_i, E_i(C), e_{i1}, e_{i2}) = \alpha \ln(\mathrm{w}_i) + \mathrm{P}_i(h_i|e_{i1}, e_{i2})u_{hi}(h_i) + \mathrm{P}_i(a_i|e_{i1}, e_{i2})u_{ai}(a_i) + \mathrm{P}_i(s_i|e_{i1}, e_{i2})u_{si}(s_i) + \mathrm{P}_i(l_i|e_{i1}, e_{i2})u_{li}(l_i) - E_i[C(e_{i1}, e_{i2})] + \varepsilon_{ei} \quad (1)$$

Using data on maternal investments along with data on expected returns and costs measured prior to the investment decision, our empirical analysis seeks to make inference (up to scale) on the parameters of the mother's utility function. This will illuminate whether variation in investments observed across children originates from variation in expectations about returns, expectations about costs, or preferences.

We acknowledge that this simple model abstracts from potentially important considerations. First, the maximisation problem (1) is assumed to be made without any constraints. The investments we focus on when the child is age 3 months do not carry a direct monetary cost, and foregone earnings are not relevant in our sample as female labour force participation is essentially inexistent.[8] As such, credit constraints will not directly restrict investments in our set-up but we will nevertheless allow effort cost to depend on household wealth or income. We also allow investments to be influenced by time constraints. We already account for this, in part, by introducing expected effort costs. However, in specification checks, we will produce separate estimates for households in which the mother is more vs less likely to be time-constrained to assess if the results are different. Second, assuming separability in the utility function implies that the utility a mother receives from any one developmental outcome is independent from the utility she receives from others. This makes elicitation of subjective expectations more tractable and allows us to capture "first order" effects in a context where we still know very little. Third, the model abstracts from endowment effects. This is a realistic assumption in our rural setting, as birth weight is typically not measured and healthcare workers do not monitor child health with any known metric, or provide scaled feedback.[9] Despite these caveats, the model captures the main trade-offs that a mother faces in her decision-making process and can be estimated with the expected return and cost data we collected without making restrictive assumptions on the mother's knowledge about the production function for skills and on the effort cost that the investments entail.

[8] Only 6% of mothers responded they normally work. Although women's labour force participation is in general low in this region, recall that the women in our sample are pregnant and baseline and three months post-partum at follow-up.

[9] Note also that to account for endowments, one would need to elicit expectations conditional on various endowments level, which implies that the number of questions increases n-fold for n endowment levels as, for instance, in Cunha et al. (2013) and Boneva and Rauh (2018), and increases survey time as well as respondents' burden.

3. Study Design

3.1 Sample

The data were collected as part of a longitudinal cohort study called *Bachpan* (which means childhood in Urdu) in rural and peri-urban Pakistan in 2016-2017. The data were collected electronically using tablets, uploaded daily to the main server, and checked weekly for inconsistencies. Although not used in our analysis, the study incorporated a cluster-randomized control trial addressing perinatal depression with a cognitive behavioural therapy approach. As a result, the study over-sampled depressed women. A description of the data is available in Sikander et al. (2015) and Turner et al. (2016). In total, 1154 pregnant women were recruited in 40 clusters, 570 of whom were screened positive for a depressive disorder, and enrolled in the depression trial, with around half in each of the intervention and control arms. The remaining 584 women were not depressed in pregnancy. Baseline data were collected when mothers were in their third trimester of pregnancy, the time of recruitment into the study. At that time, women had not yet received any form of treatment for depression. Depression was assessed using the patient health questionnaire (PHQ-9), which queries a series of symptoms of depression (see Data Appendix for a detailed list of all items evaluated). The intervention was a positive thinking therapy focusing on the mother's personal health, her interactions with the child, and with others (Atif et al., 2017). We do not use the trial-induced variation because the expected returns and effort cost data were collected at baseline.[10]

We use two different samples for our analyses. We elicited expected returns and costs of early-life investments for all women in the baseline data (depressed and not depressed and irrespective of their treatment arm allocation), and these are the data used to describe expected returns and costs. This *first sample* includes 1,090 women given an item non-response rate of 5.6% on the questions pertaining to expected returns and cost. Maternal investments were measured in a follow-up survey carried out when the children were 3 months old. For the main analysis modelling investments (section 5), we exclude mothers in the intervention arm. This is to be conservative and address the possibility that the depression intervention had a direct effect on parenting behaviour, but we investigate sensitivity of our results to this restriction.[11] This *second sample* consists of 626 women. The lower sample size at the 3 month survey reflects a 23% attrition rate between waves (including 8% of miscarriage/stillbirth, 1% of women not surveyed

[10] Sikander et al. (2019) found no treatment effect on symptom severity or remission from perinatal depression at 6 months after childbirth, but they found that the intervention was beneficial on some other metrics of severity and disability.

[11] We nonetheless do not find any significant association of the depression intervention on actual maternal investments at month 3.

due to child's illness, and 14% of women not surveyed for other reason which we know is primarily because many mothers in these communities go to live with own mother soon after giving birth).

Given that the trial oversampled women with depression, we use two different sets of weights to account for the regional prevalence of maternal depression, which was 30%. We first weight observations at baseline to account for the difference between the real prevalence of maternal depression and the share of depressed mothers in our sample, and we construct a second weight variable to account for the exclusion of mothers receiving the intervention when examining the link between maternal beliefs and investments at 3 months.[12] Nevertheless, we confirm that our results are insensitive to the inclusion of treated mothers in the model estimation and to using weights.

Tables 1a and 1b provide descriptive statistics for (1) the original unweighted sample; (2) the baseline weighted sample which we will be using to describe elicited expectations over returns and costs; and (3) the 3-month weighted follow-up sample which we use to measure maternal investments. Mothers in our sample are 26 years old on average, with a mean parity of 2.5 children including the current pregnancy, and about 30% of them are pregnant with their first child. They have, on average, about 8 years of completed education, around 33% of them have 5 or fewer years of education, and their labour force participation rate is very low, at 6%. The difference between the weighted and unweighted samples is primarily in depression levels (since the weights are designed to map the 30% depression prevalence of the study area) and in variables known to be associated with the incidence of maternal depression- namely education, wealth and parity.[13] There are no statistically significant differences in variable means between the weighted samples at baseline and 3 months. Appendix Table A1 presents descriptive characteristics by attrition status. Column (1) presents characteristics for women who are included in the 3-month sample and column 2 for women who are not. Reassuringly, demographic characteristics as well as expected returns and effort costs are similar across the two groups, so it does not seem that at 3 months we have a selected sample of the women at baseline.

3.2 Expected returns, Effort Costs and Maternal Investments

Measuring expectations. We elicit maternal beliefs on the productivity of early-life investments

[12] The weights are constructed by post-stratification. In our sample, the two strata considered are depressed and non-depressed. Each weight is constructed by adjusting the observations in each stratum such that with independence of the sample used, the weighted prevalence of depression in the sample matches the overall depression rate in the study region.

[13] The Data Appendix details the construction of the wealth measure.

using visual aids, as is commonly done in developing countries (Delavande and Kohler 2009, Delavande 2014). In particular, we used a card with bars numbered from 0 to 10. Each bar is made up of equal-sized blocks (e.g., 1 block for 1, 3 blocks for 3) and we explain that one block means one chance out of ten. The Data Appendix details the survey design. We started with a preamble intended to explain the notion of a probability, followed by a question designed to test whether women had understood the concept.

We then directly elicited probabilities for whether a child will reach specified developmental milestones conditional on high vs low levels of maternal investment.[14] These questions were framed with reference to a mother and child in the community rather than with reference to the respondent and her child. As such, we expect the responses to capture beliefs about each woman's expectations of the technology of skills formation in her community. The questions focus on two key investments (exclusive breastfeeding and guided play) and four child developmental outcomes: experiencing frequent diarrhea (health), putting 2-3 words together in speaking by age 2 (cognitive ability); playing happily with other children by age 3 (socio-emotional development) and learning well at school. The high and low levels of maternal investment were specified as exclusive breastfeeding for 6 months versus not doing this and playing frequently with the child to help her learn new things versus playing rarely. For example, the questions were phrased as:

In your view, what is the likelihood that a child will put 2-3 words together in speaking by the age of 2 years:

(i) If the mother plays with the child frequently to help them learn new things?

(ii) If the mother rarely plays with the child to help them learn new things?

Importantly, the questions were asked in pregnancy *before* any investments were made, to avoid any feedback from investments to beliefs.

Effort cost. We elicited expected effort costs associated with making the investments by asking mothers at baseline (before birth) to report on a Likert scale how tiring they expected it would be

[14] Cunha et al. (2019) discusses two ways to measure maternal subjective expectations. The first relies on asking mothers the likelihood that a milestone will be reached like we do. The second asks mothers to report what they think the youngest and oldest age is at which a child will reach a milestone, which requires additional steps to transform answers into probabilities. This is also the method adopted in Attanasio et al. (2019) in Columbia. In Cunha et al. (2019), the probabilities elicited using the first method appear uncorrelated with the difficulty of the milestone considered but both methods yield measures of beliefs that behave sensibly, for instance, being correlated with investments as measured by the HOME score. We used probabilistic beliefs as they have worked well in many different low income settings (see Delavande 2014 for a review). Moreover, even in developed countries, individuals tend to have difficulties with providing a minimum and a maximum, as shown by the low response rate in Dominitz and Manski (2011). Finally, beliefs elicited with the format we use can be analysed without making any assumptions on maternal beliefs about the shape of the production function for skills.

to breastfeed or to play with a baby (see Data Appendix).

Measuring maternal investments. During the 3-month follow up interviews, we measured the two maternal early life investments for which we had gathered data on beliefs regarding returns and costs. To measure *exclusive breastfeeding,* mothers were asked about all the nutrients given to their child in the last 24 hours (see Data Appendix for a complete list of all the nutrients evaluated and Appendix Table A2 for a detailed summary of feeding practices in our study area). Mothers are considered as exclusively breastfeeding if they are giving only breast milk. While 93% of mothers are breastfeeding their 3-month old baby, only 49% are exclusively breastfeeding (Table 1c). *Guided play* is a question collected within the Infant-Toddler Home Observation Measurement of the Environment (HOME) inventory questionnaire designed for children aged 0-3 (Cox and Walker 2002) asking the mother whether she guides the child during play. See Appendix D for details. We focused on this particular question as it matches very closely the investment portrayed in the expectation questions. Using this variable, 33% of mothers were guiding during play with their 3-month old baby. We conduct robustness checks replacing the chosen play question with alternative multiple items from the HOME inventory in Section 6.

Why early infancy. As our focus on very early infancy is an important feature, we briefly elaborate its rationale here. The velocity of physical and cognitive growth is higher in infancy than at any later period in life and there is considerable developmental plasticity, making the newborn child particularly sensitive to environmental influences including nutrition and stimulation, the two investments that we analyze (Barker 1990, 1995 Bateson et al., 2004, Almond et al. 2018). In a context similar to ours (Bangladesh), Hamadani et al. (2014) show that significant cognitive delays between children of different socio-economic backgrounds are apparent as early as 7 months old, motivating the need to investigate differences in parental investments in the very first months of a child's life. Once differences in initial conditions develop, they tend to be "self-productive" and to exhibit dynamic complementarity with subsequent investments, as a result of which inequalities widen with age (Cunha and Heckman 2007). As a result, infancy is a critical period for investment (Heckman and Kautz 2014). Our focus on early infancy also facilitates a cleaner analysis by limiting the agency of the child (the relevance of which is discussed for instance in Heckman and Mosso 2014), allowing us to isolate determinants of maternal investment from data on mother's expectations and effort cost.

4. Description of Investment, Expected Returns and Effort Costs

4.1. Heterogeneity in Investments

We estimate conditional associations of maternal investments with baseline values of the mother's education, wealth and depression status using linear regression (Appendix Table A3). Exclusive breastfeeding does not vary with any of these characteristics, but play does. Mothers who are asset poor or depressed in pregnancy are significantly less likely to guide their 3-month old baby during play, possibly indicating that time and energy constraints are more likely to bind in these cases.

Our analysis focuses on joint investments, allowing that women either make both investments, neither, or one and not the other. In our sample, 36% of mothers make neither investment, 32% breastfeed but do not guide play, 15% do not breastfeed but guide play, and only 18% make both investments when the child is age 3 months (Table 1c).We observe a wealth and depression gradient in indicators of joint investments (Table 2). We find that 20% of mothers with wealth above the sample median, in contrast to 15% with wealth below the median make both investments, while 33% of wealthier mothers compared with 39% of less wealthy mothers make neither investment. Similarly, 20% of non-depressed mothers in contrast to 11% of depressed mothers make both investments, while 34% of non-depressed mothers and 41% of depressed mothers make neither investment (Figure A1).

4.2. Expected returns to maternal investments and effort cost

Subjective expectations data: We describe the expectations in more detail before discussing data quality considerations. The individual subjective probabilities for the two maternal investment scenarios and the four developmental outcomes are displayed in Figures 1a and 1b. The figures reveal considerable heterogeneity in expectations, with probabilities taking all values between 0 and 1. The modal answer is 1 in the high-investment scenario and 0.5 in the low-investment scenario (with the exception of the case of returns to breastfeeding in terms of lower diarrhea). Figures 2a and 2b transform the data into *expected returns* (i.e. difference in expected outcomes between the high and low investment cases). Three behavioural tendencies emerge from these figures: (*i*) On average, women perceive positive returns to both investments: 74 to 82% of women report higher chances of positive child developmental outcomes with the investment than without[15]- and the expected returns are large, varying between 16 pp (for playing-diarrhea) and 39 pp (for breastfeeding-diarrhea). (*ii*) Breastfeeding is expected to have the largest impact on child health (an average 39 pp expected reduction in the likelihood that the child will experience diarrhea), relative to no breastfeeding. On the other hand, playing is

[15] An exception is that only 55% of mothers estimate a positive return to playing in terms of reduced incidence of diarrhea. We may have expected most mothers to report zero returns from playing on diarrhea but we see in Figure 2b that only 22% did. However, debriefing during the pilot revealed that several respondents reported that playing with the child would, by increasing their time together, enable the mother to spot early signs of diarrhea and act on them quickly.

expected to be most effective in influencing learning (with an average increase of 35 pp that the child will learn well at school) and cognitive outcomes (with an average increase of 33 pp that the child will put 2-3 in speaking words by age 2). These differences are all statistically significant at conventional levels.[16] Playing is expected to have only a limited impact on health – notice the large heaping in Figure 2b indicating that 22% expect a zero return. (*iii*) There is substantial heterogeneity in expected returns. For instance, the expected return from breastfeeding on diarrhea is 20 pp in the bottom quartile and 60 pp in the upper quartile. Similarly, the expected return from playing on learning is 10 pp in the bottom quartile and 60 pp in the upper quartile.

We investigated if the heterogeneity in expected returns is correlated with demographic and socio-economic characteristics of the mother. Simple regressions are in Tables 3a and 3b, and the corresponding distributions in Appendix Figure A2. There is an education gradient for most investment-outcome pairs and a wealth gradient for some, in line with the finding of Cunha et al. (2013, 2019) that women of low socioeconomic status tend to have downward biased beliefs.[17]

There is no evidence in our sample that depression modifies beliefs, in contrast to the priors set out in de Quidt and Haushofer (2016).[18] We might expect higher parity mothers to have different beliefs than those expecting their first child as they may have had the opportunity to learn from previous children, although this will matter less if they also learn from their peers. However, we find that beliefs of first-time mothers are in general not systematically different from those of more experienced mothers.

We observe that 19% of women report a zero return for at least one investment-outcome pair, which is a plausible answer. More educated mothers are less likely to report four or more zero returns (column 3, Table A5). A lot of the heterogeneity in expectations is left unexplained by mother characteristics (R-square in Tables 3a and 3b is always below 0.05). This is typically the case with expectations data, even in other domains.

---

[16] The difference between the expected return on learning and the expected return on speaking from playing frequently with the child is not statistically significant if calculated as an unpaired sample mean difference, but it is at the 5% level using a paired t-test.

[17] The education gradient is essentially a difference between mothers with no education (15% of the sample) vs some education. For example, mothers with any education at all expect that exclusively breastfeeding for 6 months reduces the probability that a child experiences diarrhea by 8.5pp more than women with no education (column (4), Table 3a). Wealth is measured as an index of asset ownership.

[18] We use a binary measure of maternal depression based on each of the SCID and the PHQ-9 following the psychometric literature. There is no gradient even if we use different cut-off of the depression score (Appendix Tables A4a and A4b). This may be due to the fact that women answer questions about the technology of skills in their community. But we find similar results when using beliefs about own child and own investment elicited when the child is 36 months in questions related to school readiness and ability to share.

Data quality considerations: We conduct several validity checks to assess the quality of the expectations data. We started our expectations module with a test question asking about the likelihood of a woman in their community going to the market (i) in the next 2 days and (ii) in the next 2 weeks. The distribution of respondent answers to these questions is displayed in Appendix Figure A3. The figure shows a clear shift of the distribution to the right when the time horizon increases, highlighting that women recognize that the probability of going to the market is higher the longer the time span. Only 3.3% of respondents violated the monotonicity property of probabilities by reporting a strictly larger likelihood for the shorter time horizon, which is similar to what has been found in other developing country contexts, and at the lower end compared to other surveys in developed countries (Delavande and Kohler 2009, Delavande et al. 2017).

In addition, item non-response is overall low, at 5.6 %. We also investigate the extent to which an individual woman provides the same answer to the series of probabilistic questions, as this might indicate that she is paying limited attention to the questions. Figure A4 shows the distribution of repeated values of beliefs for the high and low investment levels for the same woman. Only about 10% of women provided four or more repeat combinations of answers in the probabilistic questions out of the eight outcome-investment combinations, and about 20% did not repeat any combinations, which is reassuring.

We would not expect women to report negative returns, as this would suggest that breastfeeding or playing with the child are detrimental to child development indicators, but 22% report more than one negative return. Investigating characteristics of women who reported negative expected returns, we find they are more likely to have no education and wealth below the median.[19] We will investigate how the model estimates change if we exclude women who report negative returns (see section 6).

There are no reliable estimates of the parameters of the actual production function for skills in this context. However, the beliefs data are consistent with benchmark provided by the Pakistan 2012-2013 Demographic Health Survey (DHS) and data presented in Cunha (2019) for a US sample. The DHS shows that the proportion of children that experienced diarrhea in the two weeks prior to the interview was 25-33% (depending on the child's age), which is similar to the average expected likelihood of frequent diarrhea in our sample when the mother exclusively breastfeeds (25%) or guides play (35%) in our sample (Table 1b and Appendix Table A6). Cunha

[19] Among women with no education and wealth below the median, 31% and 28% respectively report more than one negative return, compared to 21% and 16% of women with more than 10 years of education and SES above the median respectively, see Column 4 of Appendix table A5 for a more detailed picture.

(2016) documents that 72% of children in a US sample spoke partial sentences by the age of 2, comparing well with 70- 74% in our sample for the high investment scenario. Women in the US sample expect an 82% chance of a 2-year old speaking a 3-word sentence with high investment and high endowment, which is comparable to our sample. Expectations in the low investment and low endowment scenario in the US sample are also very similar to the expectations under low investments in our sample, at 46%. Although crude, these comparisons suggest that the subjective expectations of sample women are broadly in line with outcome realizations.

Overall, women appear comfortable reporting probabilistic beliefs using the 10 bar score card; the vast majority respects basic probabilities properties; we find a socio-economic gradient in expected returns to early life investments as has been found in other settings (e.g., Cunha et al., 2013 and Boneva and Rauh 2018), and average probabilities of reaching specific milestones are consistent with the available evidence. Moreover, very few women repeat their answers. This gives us confidence in using the expected return data in our empirical analysis.

Expected effort costs of maternal investments. Using a binary indicator of whether the mother reports that the investment is either sometimes or most of the time tiring, we observe that 39% report that breastfeeding is tiring, and 35% report that playing with the child is tiring, see Figure 3. Investigating heterogeneity in expected effort costs in Table 4 and Appendix table A7, we find that more educated mothers are less likely to expect breastfeeding and playing to be tiring. For example, mothers with 6-10 years of education are 13 pp less likely to expect to feel tired from breastfeeding compared to mothers with no education and 21 pp less likely to expect to be tired from playing. The education gradient in breastfeeding is attenuated when controlling for wealth but the education gradient in playing persists. There is a significant wealth gradient in the expected costs of investment, steeper than for expected returns. Importantly, there is a significant gradient in costs by maternal depression. Depressed mothers are 9.7 pp and 8 pp more likely to expect that breastfeeding and playing respectively will be tiring. Also, consistent with intuition, older mothers are more likely to expect playing to be tiring.

We find a tendency for a positive association between expected returns and costs, even after controlling for mothers' characteristics (see Appendix Table A8). This finding goes against the idea that mothers who anticipate higher returns for an investment internalize the cost of the investment and do not view it as costly. This underlines the importance of collecting effort costs data alongside expected returns data because omitting costs might lead us to over-estimate the role played by expected returns.

5. Empirical Results

5.1 Identification and Empirical Specification

We seek to estimate the parameters of the utility function described in Section 2 using the data described in Sections 3 and 4. Recall that the mother's problem is to choose the investment levels (e_{i1}, e_{i2}) that maximize her subjective expected utility given in equation (1). Therefore, the probability that mother *i* chooses investment levels $(e_{i1} = j_1, e_{i2} = j_2)$ conditional on household income w_i, expected returns P_i and cost $E_i(C)$ is given by:

$$\Pr\big(e_{i1} = j_1, e_{i2} = j_2 | \mathrm{w}_i, P_i, E_i(C)\big) = \Pr\begin{bmatrix} \mathrm{E}U_i(\mathrm{w}_i, P_i, E_i(C), j_1, j_2) > \mathrm{E}U_i(\mathrm{w}_i, P_i, E_i(C), t_1, t_2), \\ \forall\ (t_1, t_2) \neq\ (j_1, j_2) \end{bmatrix} \quad (2)$$

Because of survey time and complexity limitations, we were forced to ask a limited set of questions. We therefore need to make some additional assumptions in order to be able to estimate equation (2). We first assume that the mother gets utility level ω_j if the child reaches the milestone for outcome *j*, and zero otherwise. I.e., $u_{aj}(a_j) = \omega_j I[a_j > \bar{a_j}]$, where $\bar{a_j}$ is a certain level of the outcomes considered (**Assumption 1**). Developmental thresholds are set at the levels defined by our belief elicitation questions.[20] Second, although we are making inference using the expected probability distribution of joint investments $\mathrm{P}_i(a_i|e_{i1}, e_{i2})$, women were asked their expected returns from individual investments, i.e., $\mathrm{P}_i(a_i|e_{i1})$ and $\mathrm{P}_i(a_i|e_{i2})$. We assume the mother sets the other investment at the modal value of the investments in the community (i.e., no playing and no exclusive breastfeeding). This assumption is motivated by the fact that the vast majority of respondents report the mode of their distribution of beliefs when asked for a point estimate (Delavande and Rohwedder, 2011) (**Assumption 2**) Our baseline specification assumes that there is no subjective complementarity between the investments, i.e. $\mathrm{P}_i(a_i|e_{i1}, e_{i2}) = \max(\mathrm{P}_i(a_i|e_{i1}), \mathrm{P}_i(a_i|e_{i2}))$ (**Assumption 3**), but we test the sensitivity of our results to this assumption in Section 6.

We also make some parametric assumptions for the specification of costs as follows (**Assumption 4**):

$$E_i\mathrm{C}(e_{i1}, e_{i2}) = \delta_1 I(e_{i1} = 1) \times I_i(\, e_1\ is\ costly) + \delta_2 I(e_{i2} = 1) \times I_i(e_2\ is\ costly\,) + + \beta_{e1,e2} X_i,$$

[20] Recall that the milestones are: not experiencing diarrhea frequently, the ability of putting 2-3 words together in speaking by age 2, the chances of playing happily with other children by age 3, and the ability to learn well at school.

Where $I(e = 1)$ is a binary indicator function equal to 1 if mother *i* engages in investment e and $I_i(e\ is\ costly\ )$ is a binary indicator function equal to 1 if mother *i* expects investment e to be costly. This means for example that mother *i* expects to incur the cost δ_1 of breastfeeding if she breastfeeds and expects breastfeeding to be tiring. Similarly for the cost δ_2 of playing. Mothers who report that breastfeeding or playing is not tiring have a cost of zero. To capture systematic differences in investments by mothers' characteristics, we also show results that include characteristics X_i in the cost function consisting of the mother's age, education, parity, husband's education, a household-assets wealth index, the gender of the newborn, and baseline depression status.

Assuming the random terms ε_{ei} to be independent for every individual *i* and investment level $e = (e_{i1}, e_{i2})$ and with a Type I extreme value distribution (**Assumption 5**), we estimate equation (2) using a multinomial logit model where the four choices are: (*1*) neither breastfeed nor play with the child, (*2*) breastfeed but not play, (*3*) play but not breastfeed, and (*4*) both breastfeed and play. Using the elicited expected returns and costs data, we make inference on the structural parameters $\omega_j, \delta_j, \beta_{e1,e2}$. The preference parameters ω_j are identified (up to scale) using the variation in expected returns across choices and mothers, while the cost parameters δ_j are identified using the variation in expected effort costs across choices and mothers. While the multinomial logit model has been widely used for the modelling of multiple choices, its assumptions could prove demanding for our specification of joint investments. We address this concern by also estimating a mixed logit model that relaxes the Independence of Irrelevant Alternatives (IIA) assumption.

5.2. Baseline Estimates

The estimates of the multinomial logit model are displayed in Table 5, and they are consistent with mothers valuing child developmental outcomes. We first show results assuming that mothers only value one of the four developmental outcomes (one at a time), and then we present estimates allowing all developmental outcomes to enter the mother's utility function. First, consider results for the ability to speak (columns 1 without controls in the cost function and column 2 with controls). The preference parameter ω_s is the coefficient associated with beliefs concerning the returns to breastfeeding and playing in terms of the ability to speak. It is positive and statistically significant, suggesting that maternal investment choices are determined by mothers' subjective beliefs about returns to investments *and* that they care about this developmental dimension. The estimated cost of playing, δ_2, is negative and significant,

suggesting that mothers who find playing costly are less likely to play. The estimated cost of breastfeeding, δ_1, is not statistically different from zero, suggesting that the cost of breastfeeding is not a deterrent to exclusively breastfeeding a newborn at the age of 3 months in our sample.

Columns (3) to (8) of table 5 show the estimates when we consider each of the other child developmental outcomes individually. The preference parameter for health (defined as diarrhea incidence, columns 3-4) is positive but about a third smaller in magnitude than the preference parameter for speaking, and is not precisely estimated. The preference parameters for socio-emotional development (defined as the child playing happily with other children by age 3, columns 5 and 6), is also positive, only slightly smaller in magnitude than the one associated with speaking, and borderline significant (p-value=0.074 without controls and 0.111 with controls). On the other hand, the preference parameter for learning (defined as the ability of a child to learn well in school, columns 7 and 8) is the largest in size, almost twice the size of the preference parameter for speaking, and statistically significant at the 1% level.

Controlling for mother-level covariates in the cost function does not change the magnitude or precision of the preference and cost parameters (see the first vs the second column for each outcome). As a matter of fact, maternal characteristics explain little of the variation in investments (see Table A9 which presents the effect of mother's characteristics for all investments compared to no play and no breastfeeding). Wealthier women are more likely to make both investments (breastfeeding and play), as opposed to making no investment. On the other hand, women who were diagnosed with depression are less likely to make both investments, and women who have already at least two other children are less likely to choose playing and no breastfeeding.

We next estimate equation (2) by considering the child's health, cognitive, psycho-emotional and learning outcomes jointly in the decision-making process, see columns (9) and (10) of table 5. Now only the preference parameter for learning well at school is statistically significantly different from zero at 1%. A reason for the dominance of this outcome may be that doing well at school *requires* success with the other outcomes – it requires cognitive ability (putting 2-3 words together by age 2), being healthy (lower diarrhea) and being socially well-grounded (playing happily with other children by age 3), so it may in fact incorporate concern over these other outcomes. Interestingly, the ordering of the estimated preference parameters is in line with self-reported valuations of developmental outcomes that we also elicited. In our sample, 80% of mothers responded that the ability of a child learning well is very important for a

child's development, in contrast with a share of 64 to 67% for the other outcomes (table 1a), and this difference is statistically significant at the 1% level.[21]

In all the specifications in Table 5, we find a negative and precisely estimated cost for playing, while the cost for breastfeeding is not precisely estimated.

Goodness of fit: We assess the fit of the estimated model by comparing actual investments to the model predicted probability of the investments. See Appendix table A10 which shows that the model fit is very good, not only overall but, importantly, for a number of sub-samples.

5.3. Choice Elasticity

We next use the model parameter estimates to analyse the predicted responsiveness of investment choice to changes in expected returns and costs. We focus on the specification that estimates the preference parameters for all developmental outcomes jointly (Column 10, Table 5), and report results for expected returns in terms of the probability of a child learning well at school.

Results are shown in Table 6. A 1% increase in the expected return to breastfeeding increases by 0.47% the predicted probability that a woman decides only to breastfeed, and reduces the probability of neither breastfeeding nor playing by 0.23%. A 1% increase in the expected return to playing with the child increases the predicted probability of playing by 0.62 %, which is the same increase in the probability of making both investments when the expected return from both increases by 1%.

We next look at the elasticity of investments to expected costs (last column of Table 6). A 1% increase in the cost of playing (playing becomes more tiring as opposed to not tiring) reduces the predicted probability of a mother playing with the child by 0.15 % (irrespective of whether or not she also breastfeeds). Since we found no evidence that the perceived costs of breastfeeding influence mother's choices, we do not explore responsiveness to this cost.

The elasticities with respect to expected returns are about 4 to 5 times larger than in studies investigating the elasticities of educational choices to expected earnings (Arcidiacono, 2004; Wiswall and Zafar, 2015; Delavande and Zafar, 2019). For example, also in Pakistan, Delavande and Zafar (2019) report elasticities of 0.12 There are no previous studies of the elasticity of maternal investment with respect to perceived costs.

[21] We refrain from drawing conclusions about the mother's ranking of preferences for educational attainment or language development over health, recognizing that our marker for health at 3 month (frequent diarrhea) is only one indicator of health, and one that, in poor communities in Pakistan, is so common that it may be regarded as "natural".

5.4. Willingness to Pay

Our estimates have shown that mothers value child developmental outcomes, most of all learning well at school, and that they incur an effort cost of playing. In this section, we seek to monetize these results. We calculate the factor *g* by which family income would need to be increased to keep the mother's utility constant when the probability of her child's outcome *j* decreases from π_1 to π_2, i.e. we solve:

$$\beta \ln(w_i) + \pi_1 u_{ji}(\mathrm{j}) = \beta \ln(w_i \times \mathrm{g}) + \pi_2 u_{ji}(j)$$

Table 7 displays the results. We take the average of the three coefficients associated with income from the multinomial logit results, and evaluate income at the sample mean and median. We estimate that mothers would be willing to forgo 60% of household monthly income to increase the probability of their child learning well at school by 10 pp, and 41% to reduce by 10 pp the effort cost of playing.[22]

These estimates are useful in affording a metric with which to compare the relative importance of expected returns and costs but we are wary of interpreting them as a measure of the absolute willingness to pay, as this will depend on factors such as the period over which the mother obtains utility, and the period for which the investments are made.

5.5. Heterogeneity in preferences

So far, we have assumed that all mothers have the same preference parameters for child development ω_j and effort cost parameters δ_j. We now relax this assumption to evaluate whether heterogeneity in preferences over child developmental outcomes explains heterogeneity in investment decisions. We do this in two ways. First, we estimate a mixed logit model where the parameters ω_j are assumed to have a normal distribution.[23] The mixed logit relaxes the Independence of Irrelevant Alternatives (IIA) imposed by the multinomial logit. The results in Table A12 indicate no heterogeneity in preferences for child development, as we systematically reject the hypothesis that the variance of the normal distribution of ω_j is different from zero. Second, we interact the expected returns and effort costs with mother characteristics, allowing ω_j, δ_1 and δ_2 to be different for mothers with high and low education levels (Column 1), high

[22] For this exercise we replace the asset-based index proxying wealth with the log of household income in the baseline estimation. Appendix table A11 shows that the estimated preference and cost parameters are similar to the main results in Table 5.

[23] When estimating the mixed logit model we replace the categorical variables of education and parity with their continuous version in order to achieve convergence.

and low wealth (Column 2), and for depressed and non-depressed mothers (Column 3), see Table 8. In general, we find limited evidence of heterogeneity by these characteristics.[24]

All in all, these results point to limited if any systematic differences in mothers' valuations of child development outcomes, suggesting that differences in expected returns and effort costs are the main drivers of the observed differences in investment levels in children. This is in contrast to Cunha (2014) that finds that white parents value children developmental outcomes significantly more than black parents in the US based on hypothetical choice questions. Using simulations, he concludes that heterogeneity in preferences is important to understand the racial gap in parental investments.

6. Robustness checks

This section reports a series of validation and specification checks designed to assess the robustness of our results.

Investments constraints. We first discuss time constraints and then physiological constraints on breastfeeding. The maximisation problem stated in (2) abstracts away from time constraints. We allow for this to some extent by introducing expected effort costs but it is possible that women who report a low expected cost when queried in pregnancy discover an actual time constraint when breastfeeding or playing 3 months after birth. If women were in fact time constrained in their investment choices, we would expect them not to be able to act on their subjective expected returns. In this case, the coefficient associated with the beliefs would not be precisely estimated, but this is not what we see in Table 5.

Still, if some women are more constrained than others, the coefficients we estimate may be biased. We investigate this by allowing the coefficients associated with beliefs (omega) to vary with the *a priori* likelihood that a mother experiences different time constraints. First, we compare mothers living with an older female child (62% of the sample), and the rest. Given anecdotal evidence that older girls help the mother with household chores and childcare, we expect they contribute to relaxing time constraints. For the same reason, we group mothers by whether or not the child's grandmother lives in the household (55% of the sample). Third, we compare women who live in farming households (60% of the sample) and those who do not as women often contribute to farm labour, tightening time constraints. We find no systematic significant differences across these groups (Appendix Table A13). While this evidence is not

[24] There is a statistically significant difference in the health preferences parameter by depression status, but the estimates for each group are not statistically significantly different from zero. There is some evidence that less wealthy mothers value speaking more, and value health less.

conclusive, it is consistent non-binding time constraints.

We have implicitly assumed that exclusive breastfeeding is a choice. However, some mothers may be unable to breastfeed for a number of medical or physiological reasons. To investigate this, we restrict the sample to women that report always having had enough money to buy food during pregnancy, and then to women with weight above the 10th percentile at the time the investments were measured (3 months). Appendix Table A14 shows that the estimates for these relatively unconstrained samples are qualitatively very similar to those in Table 5. We are unable to test constraints imposed by the health of the child as we do not have child birth weight or any other measure of their ability to breastfeed.

Complementarity of the investments. The baseline estimation assumes that there is no (subjective) complementarity of the investments (Assumption 3). We now discuss how we assessed this assumption after the data used in the main analysis were collected. We recruited a different sample of twenty women in Pakistan of similar background to the women in this study, and elicited from them their probabilistic beliefs about the returns from making joint investments while also asking them the original questions with the investments presented independently.[25] Using responses to both sets of questions we can estimate perceived complementarities between breastfeeding and playing and correct our estimates in the main sample accordingly. More specifically, we seek to identify θ in the following equation:

$$\begin{aligned} \mathrm{P}_i(a_i|e_{i1}=1,e_{i2}=1) = \; & max\big(\mathrm{P}_i(a_i|e_{i1}=1),\mathrm{P}_i(a_i|e_{i2}=1)\big) \\ & +\theta min\big(\mathrm{P}_i(a_i|e_{i1}=1),\mathrm{P}_i(a_i|e_{i2}=1)\big) \end{aligned} \quad (3)$$

Data from this small pilot reveal an estimated θ of 0.018, or that mothers expect a complementarity among investments of 1.8%. We replicated Table 5a using equation (3) to evaluate $\mathrm{P}_i(a_i|e_{i1}=1,e_{i2}=1)$ instead of relying on assumption 3. We present estimates with the estimated θ of 1.8% and, to analyse sensitivity to the alternative values also 5% and 10%, see Appendix Table A15. The model estimates are very similar to those obtained using the baseline specification assuming no complementarity, and this is the case independently of the level of complementarity assumed.

Sensitivity to samples. We excluded treated women because of concerns that the intervention might have directly encouraged women to increase investments. As a robustness check, we re-estimated the model including treated mothers. The estimates are similar to those in Table 5, see Column (1) of Appendix Table A16.

[25] Women were asked the likelihood of a specific developmental outcome occurring when (i) the mother does not play and does not breastfeed, (ii) the mother breastfeeds but does not play, (iii) the mother does not breastfeed but plays, and (iv) the mother both breastfeeds and plays. We gratefully thank Ammara Riaz and Ayesha Riaz for invaluable help in the implementation of the questionnaire in the field.

As discussed in Section 3.2, while the elicited beliefs data are on average of high quality, some women report negative expected returns from undertaking the investments. We assess robustness of our results to how we treat these answers. First, we exclude mothers who expect more than one negative return out of eight, and the results are very similar to those in Table 5, see column (2), Appendix Table A16. In an alternative specification where we use the whole sample, we replace negative returns with zero returns.[26] Again, we obtain very similar results to Table 5, see column (3), Appendix Table A16.

Alternative definitions of play. We investigate the robustness of our results to alternative definition of the *play* investment. Instead of using one item from the HOME inventory, we use: (i) the overall HOME score; (ii) a score based on items related to stimulation (i.e. those from the Responsivity and Involvement sections); (iii) the first principal component (PCA) of the items related to stimulation. We assume that women in the top tertile in terms of these measures are those who play frequently to make it comparable to our current main playing variable. See Data Appendix for details. Table 9 results show that the results using these 3 other definitions for play are very similar to our baseline results.

Alternative specifications. Our main specification assumes that investments entail effort costs but some women may instead derive utility from playing and breastfeeding (Caucutt et al., 2017). In fact in the survey 80% of mothers report they found playing and breastfeeding enjoyable "most of the time." We re-estimated the model generalizing the cost function to allow that making the investments is enjoyable, see Column (4) of Appendix Table A16. We find that self-reported enjoyment does not predict the investment choices.

We elicited expected return and effort cost in pregnancy to avoid feedback effects from behaviour to beliefs/cost. However, our main sample includes mothers of all parity, including women who may have had the opportunity to learn from earlier pregnancies. This could bias the preferences parameters if women endowed with high expected returns were more likely to have invested and revised their beliefs upward. As a robustness check we re-estimated the model restricting the sample to mothers who were pregnant with their first child at baseline, see columns (5-6), Appendix Table A16. Although slightly less precise, the results are similar.

Finally, we also replicate our baseline model without using weights, and again, the results are robust (column 7, table A16).

Within village correlations of beliefs, cost and investments. Subjective expectations of returns and effort costs may respond to social norms. And the questions eliciting returns from

[26] This affects 8 to 11% of the sample, depending on the outcomes and investments. One exception is experiencing diarrhea with the playing investments, where this affects 24% of the sample.

individual women were phrased to ask her what she thought the returns for a generic woman in her community would be. To the extent that women live in close-knit communities, their investment behaviours may also be similar. This generates the concern that a spatial correlation in beliefs and investments could generate the results in Table 5 without women acting on their beliefs. To investigate this, we analysed the variation in beliefs, costs and investments between and within villages. See Figure A5, where panel (a) depicts a box plot of the expected return on "learning well" from breastfeeding for each of the 40 villages under study, showing considerable within village variation. Although not shown, similar variation is evident for the other developmental outcomes and investments. Panel (b) shows that there is also a lot of within village variation in the expected costs and investment realizations. Overall, this undermines the concern.

7. Policy Experiments

We use the estimated preference parameters to simulate mothers' behavioural responses to a series of different plausible policy interventions targeted at increasing breastfeeding and stimulation during early-life. These include interventions that manipulate expected returns, effort costs, mother's education and depression status. The simulations assume that all women fully comply with the intervention (e.g. they fully revise their expectations, they all recover from depression, etc…), and the results we present will therefore constitute the upper bound of the effects of an actual policy.

The estimates are in Table 10 for the full sample and in Appendix Tables 17a and 17b for various subsamples. Column (0) shows the baseline distributions of investments predicted by the multinomial logit model (Table 5, column 10), before any of the policies is introduced. We first discuss the average predicted probabilities of making the four possible investments under different **information interventions**, see columns (1)-(3). The first shifts the expected returns of less wealthy mothers to the average of wealthy mothers (i.e. above median wealth index). This has limited impacts on overall investments, consistent with the raw data showing only moderate differences in expected returns across wealth groups (7.3 pp on average) as well as with the heterogeneity in expected returns within the low wealth group. The second raises the expected return to each investment by 10 pp for all women. Now the predicted probabilities of breastfeeding and playing increase by 1.4 pp (2.9% of baseline) and 0.9 pp (2.9% of baseline) respectively. The third intervention raises beliefs by increasing the expected return to each investment by the interquartile range of the average expected return from single investments (an

increase of 43 pp on average).[27] We now see large increases in the probabilities of breastfeeding and playing of 6.3 pp (13%) and 3.8 pp (12.4%) respectively. Overall, a large increase in expected returns is required to obtain a large increase in investments.

We next simulate results of eliminating effort costs of playing. We notionally ascribe this to the creation of a **mother group** or **play group** in the community, where effort is pooled and mothers feel supported, see column (4). This is associated with an increase of 3.8 pp (12.4% of baseline) in the predicted probability of play, and a corresponding reduction in the predicted probability of not making either investment of 2 pp (5.7 %).

We then combine first the second and then the third information intervention with the cost alleviating intervention. The predicted probability of playing increases by 4.8 pp (15.3%) in the former case, and by 7.9 pp (25.5%) in the latter. Note that the effect of combining the two policies is slightly larger than their separate effect (e.g., 7.9 pp in column 6 versus 3.8+3.8=7.6pp in columns 3 and 4). This is suggestive that effort costs might prevent mothers from fully acting on newly acquired beliefs. Overall, a fairly large effect on playing can be achieved by jointly increasing perceived returns and lifting effort costs. This combined intervention is also effective at reducing the gaps in investment across groups. It reduces by about two-thirds the gap in playing between low and high educated mothers, low and high SES, and depressed and non-depressed (see Appendix table A17a).

The next simulation investigates impacts of an intervention that **treats maternal depression**, column (7). We posit that treated women are affected in three ways: the covariate indicating depression is set to zero, their expected costs are set to the average cost of non-depressed mothers, and their expected returns are set to the average returns reported by non-depressed mothers. In the subsample of depressed mothers, treating depression has, as we may expect, larger effects: an increase of 3.7 pp (7.9% of baseline in this sample) in breastfeeding and 8.2 pp (34.6%) in playing, see Appendix Table A17a, panel A, column (7). Treating depression is the policy with the largest effects in this subsample, where investments are low at baseline, with effects similar to that of the intervention that simultaneously targets an increase in expected returns and elimination of psychic costs. This is consistent with the results in Baranov et al. (2019) who find that mothers treated for depression make larger time-intensive and monetary investments in children as long as seven years after the end of the intervention.

Finally, we consider an **education** program that results in all women achieving at least

[27] The expected probability of achieving a developmental outcome cannot be higher than 1. In the scenario in which the new computed expected probability would violates this, we obtain the desired increase in expected returns by lowering the expected probability of achieving the developmental milestone when mothers do not invest.

ten years of education. The education covariate is set to 10+ years and, at the same time, the expected beliefs and costs of less educated women are set to the averages for women with 10 or more years of education. We see fairly limited effects on average (column 8, Table 10), though the effects are larger among the subsample of less educated mothers (Appendix Table A17a, column (8), panel B): for example, educating mothers increases playing by 3 ppt (10.1% of baseline in this subsample). Education is a relatively costly program compared, for instance, with providing information on returns and creating a playgroup in the community but, on the other hand, it is likely to have benefits beyond the making of investments, for instance, on choices that influence the mother's own wellbeing.

We see larger effects of some of these policies on women who report zero or negative returns (panel D of Appendix Table A17b) and on women who report high effort costs (panel E).[28] Among women who expect to find breastfeeding or playing costly most of the time, the mother group intervention increases play by 9.8 pp (41.5% of baseline), and the intervention that simultaneously increases returns and lowers costs increases play by 13.8 pp (58.5%). This is the largest increase among all the policies and subsamples we consider. While targeting interventions to these more responsive groups is currently difficult, if future household surveys elicit expected returns and costs, this problem may be alleviated.

Overall, our simulations suggest that providing information that increases women's subjective expected returns, alleviating psychic or effort costs, treating depression, and educating women all tend to increase maternal investment in children. Moreover, the returns to intervening are higher in the subgroups that are most treatable on account of low expected returns, high expected costs, baseline maternal depression, or low levels of maternal education.

8. Conclusions

Heterogeneity in maternal investments may be driven by differences in expectations about returns to investments, preferences for child development outcomes, and financial as well as psychic resources. We investigate the role of subjective expectations of returns to and effort costs of the two main investments that mothers make in newborns. We find that differences in maternal beliefs regarding the technology of skills formation, and differences in perceived effort costs associated with investments in children both contribute to explaining the observed

[28] For example, the information intervention that moves the expected returns of low SES women up to the expected returns of wealthy women yields an increase of 2.3 ppt (5.3%) for breastfeeding and 1.3 ppt (5.2% of baseline) for play among women who report at least two expected zero or negative returns (column (1), panel D), while this increase was of the order of 0.2 ppt and 0.3 ppt respectively in the aggregated sample.

variation in maternal investments across families. We find limited evidence of heterogeneity in preferences over early child development outcomes in rural Pakistan, which suggests that mothers value these outcomes similarly.

We provide the first evidence for maternal investments in newborns in a developing country of the links between socio-economic status, expected returns and investments, complementing recent work on US and UK data (Cunha et al 2013, Boneva and Rauh, 2018). We also provide the first estimates in any context that a mother's perceived cost of effort constrains her investment. Moreover, we identify one important predictor of perceived costs among mothers of newborns, which is perinatal depression.

Simulation exercises suggest that policies aimed at increasing the mother's beliefs about returns and alleviating effort costs, through providing information on returns, creating mothers' groups, or treating postnatal depression can substantially raise average investment levels. Future research is needed to better understand how to change women's expected returns. First, not all beliefs are equally responsive to information (Ciancio et al. 2020). Second, large effect on investment requires large change in beliefs. More work is also needed to identify the most cost-effective way to alleviate effort cost among new mothers, especially in low income settings where poverty and depression are widespread.

References

Adams, A., & Andrew, A. (2019). Preferences and beliefs in the marriage market for young brides. *CEPR Discussion Paper (No. DP13567)*.

Almond, D., Currie, J., & Duque, V. (2018). Childhood circumstances and adult outcomes: Act II. *Journal of Economic Literature*, 56(4), 1360-1446.

Arcidiacono, P. (2004). Ability sorting and the returns to college major. *Journal of Econometrics*, 121(1-2), 343-375.

Arcidiacono, P., Hotz, V. J., & Kang, S. (2012). Modeling college major choices using elicited measures of expectations and counterfactuals. *Journal of Econometrics*, 166(1), 3-16.

Atif N, Krishna RN, Sikander S, et al. (2017). Mother-to-mother therapy in India and Pakistan: adaptation and feasibility evaluation of the peer-delivered Thinking Healthy Programme. *BMC Psychiatry*, 17(1): 79.

Attanasio, O., & Kaufmann, K. (2014). Education choices and returns to schooling: Mothers' and youths' subjective expectations and their role by gender. *Journal of Development Economics,* 109, 203-216.

Attanasio, O., Boneva, T., & Rauh, C. (2018). Parental Beliefs about Returns to Different Types of Investments in School Children. *HCEO Working Paper 2018-032*.

Attanasio, O., Cattan, S., Fitzsimons, E., Meghir, C., & Rubio-Codina, M. (2020). Estimating the production function for human capital: Results from a randomized controlled trial in Colombia. *American Economic Review*, 110(1), 48-85.

Attanasio, O., Cunha, F., & Jervis, P. (2019). Subjective Parental Beliefs. Their Measurement and Role. *NBER Working Paper* (No. w26516).

Barker, D. J. (1990). The fetal and infant origins of adult disease. *BMJ: British Medical Journal*, 301(6761), 1111.

———. (1995). The fetal and infant origins of disease. *European Journal of Clinical Investigation*, 25(7), 457-463.

Bateson, P., Barker, D., Clutton-Brock, T., Deb, D., D'Udine, B., Foley, R. A., ... & McNamara, J. (2004). Developmental plasticity and human health. *Nature*, 430(6998), 419-421.

Becker, G., & Tomes, N. (1979). An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility. *Journal of Political Economy*, 87(6), 1153-1189.

———. (1986). Human Capital and the Rise and Fall of Families. *Journal of Labor Economics*, 4(3), S1-S39.

Biroli, P., Boneva, T., Raja, A., & Rauh, C. (2018). Parental Beliefs about Returns to Child Health Investments. *IZA Discussion Paper, No. 11336*.

Boneva, T., & Rauh, C. (2019). Socio-economic gaps in university enrollment: The role of perceived pecuniary and non-pecuniary returns. *Working paper*.

———. (2018). Parental beliefs about returns to educational investments—the later the better? *Journal of the European Economic Association*, 16(6), 1669-1711.

Britton, J. R., Britton, H. L., & Gronwaldt, V. (2006). Breastfeeding, sensitivity, and attachment. *Pediatrics*, 118(5), 1436-1443.

Caucutt, E. M., & Lochner, L. (2020). Early and late human capital investments, borrowing constraints, and the family. *Journal of Political Economy*, 128(3).

Caucutt, E. M., Lochner, L., & Park, Y. (2017). Correlation, consumption, confusion, or constraints: Why do poor children perform so poorly? *The Scandinavian Journal of Economics*, 119(1), 102-147.

Ciancio, A., Delavande, A., Kohler, H. P., & Kohler, I. V. (2020). Mortality Risk Information, Survival Expectations and Sexual Behaviors. *University of Pennsylvania Population Center Working Paper (PSC/PARC), 2020-39*.

Cohen, R. M., Weingartner, H., Smallberg, S. A., Pickar, D., & Murphy, D. L. (1982). Effort and cognition in depression. *Archives of General Psychiatry*, 39(5), 593-597.

Cox, A., Bradley, R., Caldwell, B., & Walker, S. (2002). The HOME inventory: A training approach for the UK. Pavilion.

Cunha, F. (2016). Gaps in Early Investments in Children. *Working paper*.

Cunha, F., & Heckman, J. (2007). The technology of skill formation. *American Economic Review*, 97(2), 31-47.

Cunha, F., Elo, I., & Culhane, J. (2013). Eliciting maternal expectations about the technology of cognitive skill formation. *NBER Working Paper* (No. w19144).

———. (2019). Eliciting Maternal Subjective Expectations about the Technology of Cognitive Skill Formation. *Working paper*.

Cunha, F., Heckman, J. J., & Navarro, S. (2005). Separating uncertainty from heterogeneity in life cycle earnings. *Oxford Economic Papers*, 57(2), 191-261.

Cunha, F., Heckman, J. J., Lochner, L., & Masterov, D. V. (2006). Interpreting the evidence on life cycle skill formation. *Handbook of the Economics of Education*, 1, 697-812.

DaVanzo, J., Pebley, A. R. (1993). Maternal depletion and child survival in Guatemala and Malaysia. Labor and Population Program, *RAND Corporation Working Paper 93-18*.

De Quidt, J., & Haushofer, J. (2016). Depression for economists. *NBER Working Paper* (No. w22973).

Delavande, A. (2008). Pill, Patch, or Shot? Subjective Expectations and Birth Control Choice. *International Economic Review*, 49(3), 999-1042.

———. (2014). Probabilistic expectations in developing countries. *Annual Review of Economics*, 6(1), 1-20.

Delavande, A., & Kohler, H. P. (2009). Subjective expectations in the context of HIV/AIDS in Malawi. *Demographic Research*, 20, 817.

———. (2016). HIV/AIDS-related Expectations and Risky Sexual Behaviour in Malawi. *The Review of Economic Studies*, 83(1), 118-164.

Delavande, A., & Rohwedder, S. (2011). Individuals' uncertainty about future social security benefits and portfolio choice. *Journal of Applied Econometrics*, 26(3), 498-519.

Delavande, A., & Zafar, B. (2019). University Choice: The Role of Expected Earnings, Nonpecuniary Outcomes, and Financial constraints. *Journal of Political Economy*, 127(5), 2343-2393.

Den Hartog, H. M., Derix, M. M. A., Van Bemmel, A. L., Kremer, B., & Jolles, J. (2003). Cognitive functioning in young and middle-aged unmedicated out-patients with major depression: Testing the effort and cognitive speed hypotheses. *Psychological Medicine*, 33(8), 1443-1451.

Dizon-Ross, R. (2019). Parents' beliefs about their children's academic ability: Implications for educational investments. *American Economic Review*, 109(8), 2728-65.

Dominitz, J., & Manski, C. F. (2011). Measuring and interpreting expectations of equity returns. *Journal of Applied Econometrics*, 26(3), 352-370.

Eisenhauer, P., Heckman, J. J., & Mosso, S. (2015). Estimation of dynamic discrete choice models by maximum likelihood and the simulated method of moments. *International Economic Review*, 56(2), 331-357.

Ermisch, J., Jäntti, M., & Smeeding, T. (Eds.). (2012). From Parents to Children: The Intergenerational Transmission of Advantage. Russell Sage Foundation.

Fitzsimons, E., & Vera-Hernandez, M. (2013). Food for Thought? Breastfeeding and Child Development. *IFS Working Papers* (No. W13/31).

Gelaye, B., Rondon, M. B., Araya, R., & Williams, M. A. (2016). Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry*, 3(10), 973-982.

Giustinelli, P. (2016). Group Decision Making with Uncertain Outcomes: Unpacking Child-Parent Choice of the High School Track. *International Economic Review*, 57(2), 573-602.

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., Strupp, B., & International Child Development Steering Group. (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet*, 369(9555), 60-70.

Hamadani, J. D., Tofail, F., Huda, S. N., Alam, D. S., Ridout, D. A., Attanasio, O., & Grantham-McGregor, S. M. (2014). Cognitive deficit and poverty in the first 5 years of childhood in Bangladesh. *Pediatrics*, 134(4), 1001-1008.

Heckman, J. J. & Kautz, T. (2014). Fostering and measuring skills interventions that improve character and cognition. In J. J. Heckman, J. E. Humphries, and T. Kautz (Eds.), The GED Myth: Education, Achievement Tests, and the Role of Character in American Life, Chapter 9. Chicago, IL: University of Chicago Press.

Heckman, J. J., & Mosso, S. (2014). The economics of human development and social mobility. *Annual Review of Economics*, 6(1), 689-733.

Huggett, M., Ventura, G., & Yaron, A. (2011). Sources of Lifetime Inequality. *American Economic Review*, 101(7).

Keane, M. P., & Wolpin, K. I. (1997). The career decisions of young men. *Journal of Political Economy*, 105(3), 473-522.

Kolenikov, S., & Angeles, G. (2004). The use of discrete data in PCA: Theory, simulations, and applications to socioeconomic indices. Chapel Hill: Carolina Population Center, University of North Carolina, 20, 1-59.

Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013). Poverty impedes cognitive function. *Science*, 341(6149), 976-980.

Mullainathan, S., & Shafir, E. (2013). Scarcity: Why Having Too Little Means So Much. New York: Times Books.

Navarro, S., & Zhou, J. (2016). Quantifying credit constraints, preferences, and uncertainty in a lifecycle model of schooling choice. *Working paper, Dept. Econ., Univ. Western Ontario.*

Putnam, R. D. (2015). Our kids: The American dream in crisis. New York: Simon and Schuster.

Rahman, A., Malik, A., Sikander, S., Roberts, C., & Creed, F. (2008). Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. *The Lancet*, 372(9642), 902-909.

Ronda, V. (2016). The Effect of Maternal Psychological Distress on Children's Cognitive Development. *Working Paper*.

Savage, L. (1954). The Foundations of Statistics. New York: Wiley

Schilbach, F., Schofield, H., & Mullainathan, S. (2016). The psychological lives of the poor. *American Economic Review*, 106(5), 435-40.

Sikander, S., Ahmad, I., Atif, N., Zaidi, A., Vanobberghen, F., Weiss, H. A., ... & Bilal, S. (2019). Delivering the Thinking Healthy Programme for perinatal depression through volunteer peers: A cluster randomised controlled trial in Pakistan. *The Lancet Psychiatry*, 6(2), 128-139.

Sikander, S., Lazarus, A., Bangash, O., Fuhr, D. C., Weobong, B., Krishna, R. N., ... & Patel, V. (2015). The effectiveness and cost-effectiveness of the peer-delivered Thinking Healthy Programme for perinatal depression in Pakistan and India: The SHARE study protocol for randomised controlled trials. *Trials*, 16(1), 534.

Stinebrickner, R., & Stinebrickner, T. (2012). Learning about academic ability and the college dropout decision. *Journal of Labor Economics*, 30(4), 707-748.

———. (2014a). Academic Performance and College Dropout: Using Longitudinal Expectations Data to Estimate a Learning Model. *Journal of Labor Economics*, 32(3), 601-644.

———. (2014b). A Major in Science? Initial Beliefs and Final Outcomes for College Major and Dropout. *Review of Economic Studies*, 81(1), 426-472.

Turner, E. L., Sikander, S., Bangash, O., Zaidi, A., Bates, L., Gallis, J., ... & Maselko, J. (2016). The effectiveness of the peer delivered Thinking Healthy Plus (THPP+) Programme for maternal depression and child socio-emotional development in Pakistan: study protocol for a three-year cluster randomized controlled trial. *Trials*, 17(1), 442.

UNESCO (2014). Teaching and learning: Achieving quality for all. UNESCO Global Monitoring Report 2013/4.

Wiswall, M., & Zafar, B. (2015). Determinants of college major choice: Identification using an information experiment. *The Review of Economic Studies*, 82(2), 791-824. ———. (2018). Preference for the Workplace, Investment in Human Capital, and Gender. *The Quarterly Journal of Economics*, 133(1), 457-507.

World Bank (2015). Mind, Society and Behaviour. *World Development Report 2015*, World Bank Group.

Figure 1a: Subjective probabilities of developmental outcomes by breastfeeding investment level

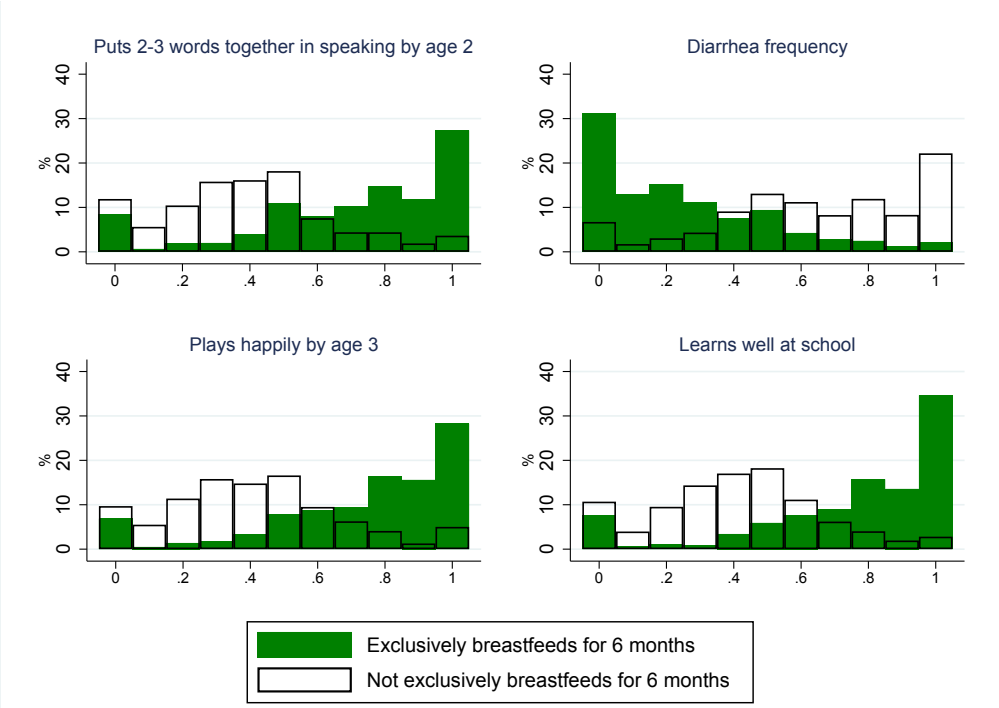


Figure 1b: Subjective probabilities of developmental outcomes by playing investment level

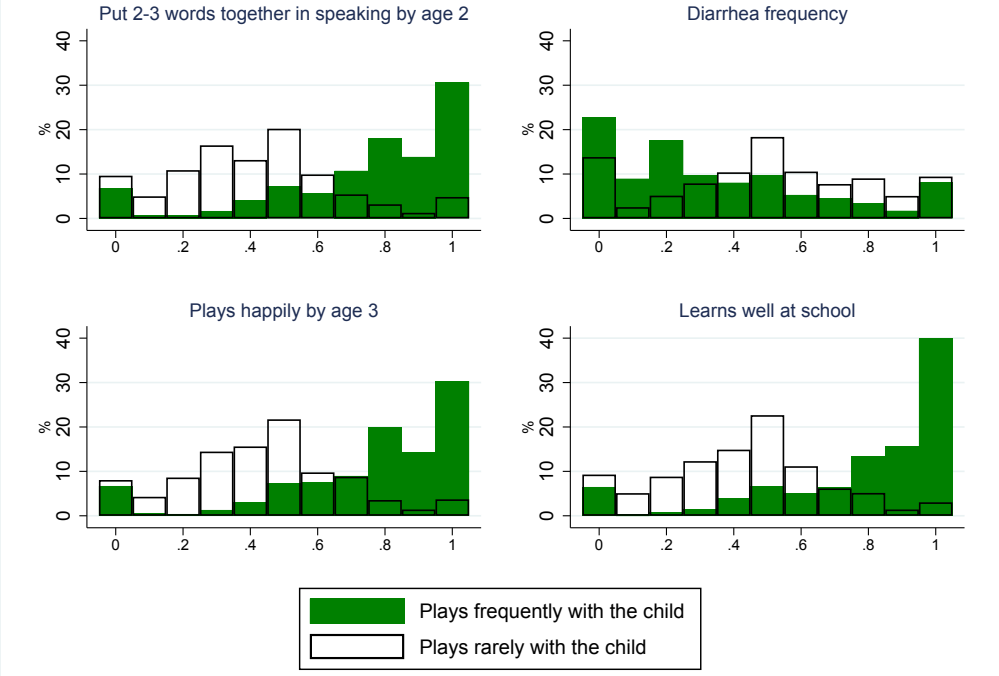
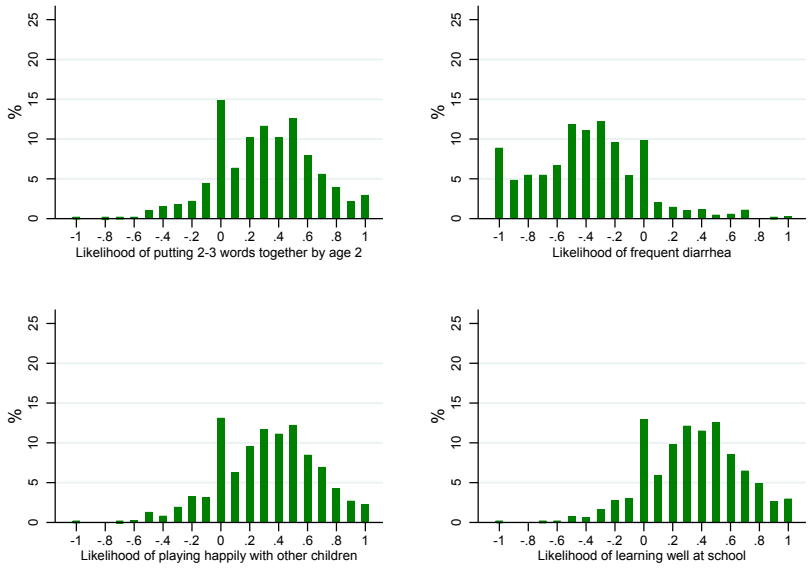
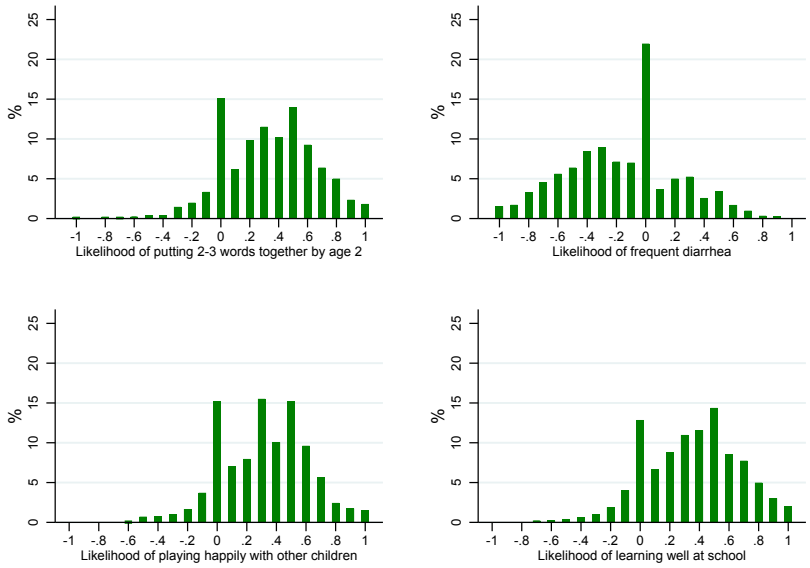


Figure 2a: Expected return from exclusively breastfeeding



Note: Individual differences in the subjective probability of children achieving developmental outcomes when a mother exclusively breastfeeds for 6 months versus if a mother does not exclusively breastfeeds for 6 months.

Figure 2b: Expected return from playing with child



Note: Individual differences in the subjective probability of children achieving developmental outcomes when a mother plays frequently with her child versus if a mother plays rarely with her child.

Figure 3: Distribution of investments' effort cost

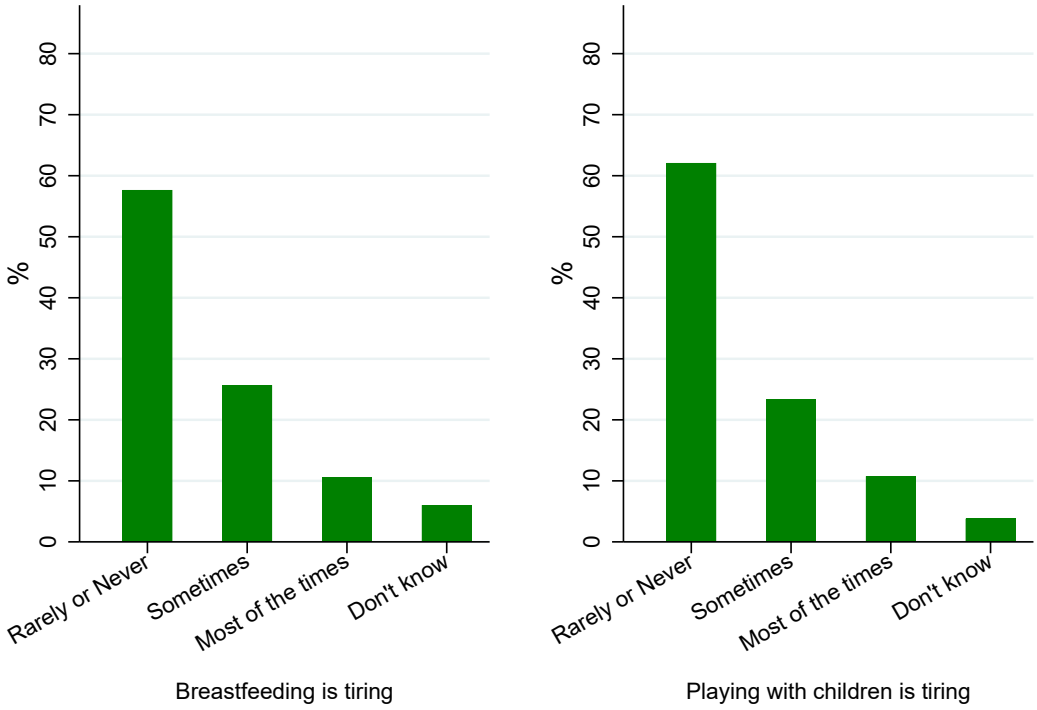


Table 1a: Baseline sample descriptives (mothers' and households' characteristics)

	(1) Non-weighted	(2) Weighted at baseline	(3) Weighted at 3 months	(4) Diff (1)-(2)	(5) Diff (2)-(3)	(6) Diff (1)-(3)
Mothers' age (years)	26.71	26.58	26.65	0.13	−0.07	0.06
	(4.54)	(4.44)	(4.51)	(0.19)	(0.20)	(0.20)
Mother's education (years)	7.70	8.04	8.03	−0.34*	0.00	−0.33*
	(4.48)	(4.45)	(4.48)	(0.19)	(0.20)	(0.20)
Husband's education (years)	8.63	8.83	8.90	−0.20	−0.07	−0.28*
	(3.42)	(3.38)	(3.30)	(0.14)	(0.15)	(0.15)
Parity	2.58	2.48	2.45	0.10*	0.03	0.13**
	(1.51)	(1.46)	(1.43)	(0.06)	(0.06)	(0.07)
Household's income (US dollars)	214.23	224.58	225.72	−10.35	−1.14	−11.49
	(170.30)	(177.32)	(181.18)	(8.74)	(9.72)	(9.56)
Mother normally works	0.06	0.06	0.06	0.00	0.00	0.00
	(0.24)	(0.24)	(0.23)	(0.01)	(0.01)	(0.01)
Woman is depressed	0.49	0.30	0.30	0.19***	0.00	0.19***
	(0.50)	(0.46)	(0.46)	(0.02)	(0.02)	(0.02)
Depression score	8.67	6.39	6.32	2.28***	0.06	2.35***
	(6.71)	(6.17)	(6.07)	(0.27)	(0.27)	(0.29)
High SES (above median)	0.50	0.54	0.55	−0.04**	−0.01	−0.05**
	(0.50)	(0.50)	(0.50)	(0.02)	(0.02)	(0.02)
Item non-response rate	0.06	0.06	0.06	−0.01	0.00	−0.01
	(0.23)	(0.24)	(0.24)	(0.01)	(0.01)	(0.01)
Mother's education (categorical)						
Education: 0 years	0.15	0.13	0.13	0.02	−0.00	0.01
	(0.35)	(0.34)	(0.34)	(0.01)	(0.02)	(0.02)
Education: 1-5 years	0.20	0.18	0.18	0.02	−0.00	0.02
	(0.40)	(0.38)	(0.38)	(0.02)	(0.02)	(0.02)
Education: 6-10 years	0.44	0.45	0.45	−0.01	0.00	−0.01
	(0.50)	(0.50)	(0.50)	(0.02)	(0.02)	(0.02)
Education: +10 years	0.22	0.24	0.24	−0.02	−0.00	−0.02
	(0.41)	(0.43)	(0.43)	(0.02)	(0.02)	(0.02)
Parity (categorical)						
Child in womb: 1st	0.29	0.31	0.31	−0.02	−0.00	−0.02
	(0.45)	(0.46)	(0.46)	(0.02)	(0.02)	(0.02)
Child in womb: 2nd	0.26	0.27	0.27	−0.01	−0.00	−0.01
	(0.44)	(0.44)	(0.45)	(0.02)	(0.02)	(0.02)
Child in womb: 3rd or higher	0.45	0.42	0.42	0.03	0.00	0.03
	(0.50)	(0.49)	(0.49)	(0.02)	(0.02)	(0.02)
Stated preferences						
Importance speaking	0.63	0.64	0.63	−0.01	0.00	−0.00
	(0.48)	(0.48)	(0.48)	(0.02)	(0.02)	(0.02)
Importance diarrhea	0.67	0.67	0.66	0.00	0.00	0.01
	(0.47)	(0.47)	(0.47)	(0.02)	(0.02)	(0.02)
Importance playing	0.66	0.67	0.66	−0.01	0.00	−0.00
	(0.47)	(0.47)	(0.47)	(0.02)	(0.02)	(0.02)
Importance learning	0.79	0.80	0.80	−0.01	0.00	−0.01
	(0.41)	(0.40)	(0.40)	(0.02)	(0.02)	(0.02)
Observations	1154	1154	871			

* p < 0.1, ** p < 0.05, *** p < 0.01.

Note: Stated preferences reflect the level of importance that mothers attach to the developmental milestones under study (putting 2-3 words together in speaking by age 2, the frequency of diarrhea episodes, playing happily by age 3, and learning well in school) in promoting a child's development (mentally and physically) in the future, and depict the share of mothers that consider the specific milestone to be important or very important against unimportant, little important, or moderately important.

Continues on next page.

Table 1b: Baseline sample descriptives (beliefs and costs)

	(1) Non-weighted	(2) Weighted at baseline	(3) Weighted at 3 months	(4) Diff (1)-(2)	(5) Diff (2)-(3)	(6) Diff (1)-(3)
Likelihood of putting 2-3 words in speaking by age 2						
If the mother exclusively breastfeeds for 6 months	0.70	0.70	0.70	−0.00	0.00	0.00
	(0.30)	(0.30)	(0.31)	(0.01)	(0.01)	(0.01)
If the mother does not exclusively breastfeed for 6 months	0.39	0.39	0.39	0.00	0.00	0.00
	(0.25)	(0.25)	(0.25)	(0.01)	(0.01)	(0.01)
If the mother plays with the child frequently	0.74	0.74	0.73	−0.00	0.01	0.01
	(0.28)	(0.28)	(0.29)	(0.01)	(0.01)	(0.01)
If the mother plays with the child rarely	0.42	0.41	0.41	0.00	0.00	0.00
	(0.24)	(0.25)	(0.25)	(0.01)	(0.01)	(0.01)
Likelihood of diarrhea episodes						
If the mother exclusively breastfeeds for 6 months	0.25	0.25	0.25	0.00	−0.00	−0.00
	(0.25)	(0.26)	(0.26)	(0.01)	(0.01)	(0.01)
If the mother does not exclusively breastfeed for 6 months	0.64	0.64	0.64	0.00	0.00	0.00
	(0.30)	(0.30)	(0.31)	(0.01)	(0.01)	(0.01)
If the mother plays with the child frequently	0.35	0.34	0.35	0.01	−0.01	0.00
	(0.31)	(0.31)	(0.31)	(0.01)	(0.01)	(0.01)
If the mother plays with the child rarely	0.51	0.50	0.50	0.01	0.00	0.01
	(0.30)	(0.30)	(0.31)	(0.01)	(0.01)	(0.01)
Likelihood of playing happily by age 3						
If the mother exclusively breastfeeds for 6 months	0.73	0.73	0.73	−0.00	0.00	0.00
	(0.28)	(0.28)	(0.29)	(0.01)	(0.01)	(0.01)
If the mother does not exclusively breastfeed for 6 months	0.41	0.41	0.41	−0.00	0.00	0.00
	(0.25)	(0.26)	(0.26)	(0.01)	(0.01)	(0.01)
If the mother plays with the child frequently	0.75	0.75	0.75	−0.00	0.01	0.00
	(0.28)	(0.28)	(0.28)	(0.01)	(0.01)	(0.01)
If the mother plays with the child rarely	0.43	0.43	0.43	−0.00	0.00	0.00
	(0.24)	(0.24)	(0.24)	(0.01)	(0.01)	(0.01)
Likelihood of learning well						
If the mother exclusively breastfeeds for 6 months	0.75	0.75	0.75	0.00	0.00	0.01
	(0.29)	(0.29)	(0.30)	(0.01)	(0.01)	(0.01)
If the mother does not exclusively breastfeed for 6 months	0.41	0.41	0.41	−0.00	−0.00	−0.00
	(0.24)	(0.24)	(0.25)	(0.01)	(0.01)	(0.01)
If the mother plays with the child frequently	0.78	0.78	0.77	−0.00	0.01	0.01
	(0.28)	(0.29)	(0.29)	(0.01)	(0.01)	(0.01)
If the mother plays with the child rarely	0.43	0.43	0.42	0.00	0.00	0.00
	(0.24)	(0.24)	(0.24)	(0.01)	(0.01)	(0.01)
Expected return of breastfeeding						
On speaking	0.30	0.30	0.30	−0.00	−0.00	−0.00
	(0.33)	(0.33)	(0.33)	(0.01)	(0.02)	(0.02)
On diarrhea	0.39	0.39	0.39	0.00	0.00	0.00
	(0.37)	(0.38)	(0.38)	(0.02)	(0.02)	(0.02)
On playing happily	0.32	0.32	0.32	−0.00	0.00	0.00
	(0.33)	(0.33)	(0.33)	(0.01)	(0.02)	(0.02)
On learning well	0.34	0.34	0.33	0.00	0.01	0.01
	(0.33)	(0.32)	(0.33)	(0.01)	(0.02)	(0.02)
Expected return of playing						
On speaking	0.33	0.33	0.32	−0.00	0.01	0.00
	(0.31)	(0.32)	(0.32)	(0.01)	(0.01)	(0.01)
On diarrhea	0.16	0.16	0.15	−0.00	0.01	0.01
	(0.38)	(0.38)	(0.39)	(0.02)	(0.02)	(0.02)
On playing happily	0.31	0.32	0.31	−0.00	0.01	0.00
	(0.29)	(0.29)	(0.29)	(0.01)	(0.01)	(0.01)
On learning well	0.35	0.35	0.34	−0.00	0.01	0.00
	(0.31)	(0.31)	(0.31)	(0.01)	(0.01)	(0.01)
Costs of investments						
Breastfeeding is tiring	0.41	0.39	0.39	0.02	−0.01	0.02
	(0.49)	(0.49)	(0.49)	(0.02)	(0.02)	(0.02)
Playing is tiring	0.38	0.35	0.36	0.02	−0.01	0.02
	(0.49)	(0.48)	(0.48)	(0.02)	(0.02)	(0.02)
Either breastfeeding or playing is tiring	0.51	0.48	0.49	0.03	−0.00	0.02
	(0.50)	(0.50)	(0.50)	(0.02)	(0.02)	(0.02)
Observations	1154	1154	871			

* p < 0.1, ** p < 0.05, *** p < 0.01.

Continues on next page.

Table 1c: Follow-up sample descriptives (investments)

	(1) Non-weighted	(2) Weighted at baseline	(3) Weighted at 3 months	(4) Diff (1)-(2)	(5) Diff (2)-(3)	(6) Diff (1)-(3)
Attrition rate	0.23	0.23	0.24	0.00	−0.01	−0.01
	(0.42)	(0.42)	(0.43)	(0.02)	(0.02)	(0.02)
Investments						
Exclusively breastfed last 24 hr	0.48	0.49	0.49	−0.01	−0.00	−0.01
	(0.50)	(0.50)	(0.50)	(0.02)	(0.03)	(0.03)
Guided play	0.31	0.33	0.33	−0.02	0.00	−0.02
	(0.46)	(0.47)	(0.47)	(0.02)	(0.02)	(0.02)
Joint investments						
Not breastfeeding and not playing	0.37	0.36	0.36	0.01	0.00	0.01
	(0.48)	(0.48)	(0.48)	(0.02)	(0.02)	(0.02)
Breastfeeding and not playing	0.32	0.31	0.32	0.01	−0.00	0.01
	(0.47)	(0.46)	(0.47)	(0.02)	(0.02)	(0.02)
Not breastfeeding and playing	0.15	0.15	0.15	−0.00	0.00	−0.00
	(0.36)	(0.36)	(0.36)	(0.02)	(0.02)	(0.02)
Breastfeeding and playing	0.16	0.18	0.18	−0.02	−0.00	−0.02
	(0.37)	(0.38)	(0.38)	(0.02)	(0.02)	(0.02)
Observations	1154	1154	871			

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Heterogeneity in joint investments

	(1) no-bf, no-pl	(2) no-bf, no-pl	(3) bf, no-pl	(4) bf, no-pl	(5) no-bf, pl	(6) no-bf, pl	(7) bf, pl	(8) bf, pl
Education: 1-5 years	−0.082	−0.066	0.028	0.050	0.025	0.004	0.029	0.012
	(0.062)	(0.065)	(0.058)	(0.056)	(0.049)	(0.052)	(0.046)	(0.044)
Education: 6-10 years	−0.016	0.031	0.010	0.057	0.012	−0.025	−0.006	−0.063
	(0.059)	(0.064)	(0.046)	(0.054)	(0.043)	(0.052)	(0.046)	(0.053)
Education: +10 years	−0.122*	−0.049	−0.011	0.067	0.095*	0.034	0.038	−0.051
	(0.062)	(0.066)	(0.054)	(0.069)	(0.050)	(0.070)	(0.052)	(0.063)
Age (years)	−0.046	−0.051	0.009	−0.003	−0.010	0.015	0.046	0.039
	(0.043)	(0.045)	(0.047)	(0.049)	(0.033)	(0.036)	(0.031)	(0.031)
Age squared	0.001	0.001	−0.000	0.000	0.000	−0.000	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Index child is female	0.012	0.015	−0.012	−0.009	0.001	−0.003	−0.001	−0.003
	(0.034)	(0.033)	(0.030)	(0.031)	(0.030)	(0.030)	(0.025)	(0.025)
Husband's education (years)		−0.001		−0.005		0.002		0.004
		(0.008)		(0.008)		(0.005)		(0.006)
Asset-based SES		−0.019		−0.012		0.006		0.026**
		(0.017)		(0.019)		(0.010)		(0.012)
Child in womb: 2nd		−0.009		0.042		−0.102**		0.069*
		(0.060)		(0.054)		(0.042)		(0.038)
Child in womb: 3rd or higher		0.047		0.065		−0.129**		0.018
		(0.051)		(0.043)		(0.049)		(0.042)
Woman is depressed		0.057*		0.030		−0.007		−0.081**
		(0.032)		(0.042)		(0.031)		(0.034)
Constant	1.064*	1.110*	0.150	0.295	0.241	−0.044	−0.455	−0.362
	(0.547)	(0.597)	(0.653)	(0.693)	(0.426)	(0.466)	(0.426)	(0.449)
Observations	662	662	662	662	662	662	662	662
R^2	0.013	0.023	0.002	0.009	0.010	0.030	0.006	0.033

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of joint investment choices on mothers' characteristics. no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing.

Sample: Excludes depressed mothers in the intervention group.

Table 3a: Heterogeneity in expected returns from breastfeeding

	(1) Bf on speaking	(2) Bf on speaking	(3) Bf on diarrhea	(4) Bf on diarrhea	(5) Bf on social	(6) Bf on social	(7) Bf on learning	(8) Bf on learning
Education: 1-5 years	0.094**	0.078**	0.102**	0.085*	0.086**	0.080**	0.108***	0.099**
	(0.037)	(0.037)	(0.047)	(0.044)	(0.038)	(0.039)	(0.037)	(0.037)
Education: 6-10 years	0.083***	0.046	0.143***	0.110***	0.079**	0.060	0.075**	0.054
	(0.030)	(0.032)	(0.041)	(0.040)	(0.039)	(0.042)	(0.035)	(0.038)
Education: +10 years	0.079**	0.026	0.131***	0.082*	0.079**	0.055	0.056	0.025
	(0.034)	(0.036)	(0.039)	(0.044)	(0.037)	(0.044)	(0.034)	(0.038)
Age (years)	0.020	0.015	0.020	0.022	0.015	0.004	0.032*	0.026
	(0.020)	(0.022)	(0.026)	(0.027)	(0.018)	(0.020)	(0.018)	(0.020)
Age squared	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.001*	−0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Husband's education (years)		0.001		0.002		0.001		0.002
		(0.004)		(0.004)		(0.004)		(0.004)
Asset-based SES		0.024***		0.017		0.017**		0.016*
		(0.008)		(0.010)		(0.008)		(0.009)
Child in womb: 2nd		0.027		0.011		0.038		0.037
		(0.025)		(0.026)		(0.030)		(0.027)
Child in womb: 3rd or higher		0.040		−0.012		0.078**		0.044
		(0.032)		(0.038)		(0.031)		(0.033)
Woman is depressed		0.013		0.035		0.008		0.017
		(0.021)		(0.025)		(0.021)		(0.024)
Constant	−0.057	0.037	−0.043	−0.079	0.060	0.211	−0.134	−0.053
	(0.289)	(0.325)	(0.354)	(0.371)	(0.264)	(0.275)	(0.255)	(0.268)
Observations	1090	1090	1090	1090	1090	1090	1090	1090
R^2	0.008	0.020	0.017	0.022	0.008	0.019	0.012	0.020

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of expected returns from breastfeeding on mothers' characteristics. Bf is short for breastfeeding. Bf on speaking = Expected return from breastfeeding on the probability that a child puts 2-3 together in speaking by age 2; Bf on diarrhea = Expected return from breastfeeding on the probability of lower incidence of diarrhea episodes; Bf on social = Expected return from breastfeeding on the probability that a child plays happily with other children by age 3; Bf on learning = Expected return from breastfeeding on the probability of a child learning well.

Sample: All mothers.

Table 3b: Heterogeneity in expected returns from playing

	(1) Playing on speaking	(2) Playing on speaking	(3) Playing on diarrhea	(4) Playing on diarrhea	(5) Playing on social	(6) Playing on social	(7) Playing on learning	(8) Playing on learning
Education: 1-5 years	0.108**	0.092**	0.091*	0.080	0.069	0.056	0.078*	0.061
	(0.041)	(0.038)	(0.051)	(0.051)	(0.042)	(0.041)	(0.044)	(0.043)
Education: 6-10 years	0.119***	0.079*	0.060	0.037	0.090**	0.057	0.072*	0.035
	(0.041)	(0.040)	(0.038)	(0.041)	(0.036)	(0.040)	(0.038)	(0.041)
Education: +10 years	0.110***	0.054	0.062	0.021	0.074*	0.024	0.090**	0.034
	(0.038)	(0.043)	(0.043)	(0.052)	(0.037)	(0.044)	(0.039)	(0.049)
Age (years)	0.067***	0.059***	−0.001	0.003	0.029	0.023	0.032*	0.029
	(0.020)	(0.019)	(0.024)	(0.025)	(0.018)	(0.018)	(0.017)	(0.018)
Age squared	−0.001***	−0.001***	0.000	−0.000	−0.001*	−0.000	−0.001*	−0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Husband's education (years)		−0.002		0.007*		0.003		0.001
		(0.004)		(0.004)		(0.003)		(0.004)
Asset-based SES		0.029***		0.001		0.018**		0.022***
		(0.007)		(0.011)		(0.008)		(0.008)
Child in womb: 2nd		0.072***		−0.029		0.056**		0.030
		(0.021)		(0.030)		(0.025)		(0.028)
Child in womb: 3rd or higher		0.036		−0.023		0.027		0.011
		(0.025)		(0.037)		(0.028)		(0.031)
Woman is depressed		0.003		0.004		0.005		0.014
		(0.019)		(0.017)		(0.019)		(0.022)
Constant	−0.673**	−0.543*	0.107	0.024	−0.122	−0.056	−0.134	−0.095
	(0.277)	(0.278)	(0.344)	(0.360)	(0.253)	(0.265)	(0.237)	(0.251)
Observations	1090	1090	1090	1090	1090	1090	1090	1090
R^2	0.025	0.046	0.004	0.009	0.013	0.027	0.010	0.021

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of expected returns from playing with the child on mothers' characteristics. Playing on speaking = Expected return from playing on the probability that a child puts 2-3 together in speaking by age 2; Playing on diarrhea = Expected return from playing on the probability of lower incidence of diarrhea episodes; Playing on social = Expected return from playing on the probability that a child plays happily with other children by age 3; Playing on learning = Expected return from playing on the probability of a child learning well.

Sample: All mothers.

Table 4: Effort costs by characteristics

	(1) Breastfeeding is tiring	(2) Breastfeeding is tiring	(3) Playing is tiring	(4) Playing is tiring
Education: 1-5 years	−0.078	−0.041	−0.142**	−0.094*
	(0.061)	(0.061)	(0.057)	(0.055)
Education: 6-10 years	−0.127**	−0.049	−0.212***	−0.107**
	(0.051)	(0.055)	(0.044)	(0.048)
Education: +10 years	−0.161***	−0.054	−0.246***	−0.096
	(0.058)	(0.069)	(0.054)	(0.059)
Age (years)	0.045	0.053	0.068**	0.073**
	(0.031)	(0.032)	(0.030)	(0.031)
Age squared	−0.001	−0.001	−0.001**	−0.001**
	(0.001)	(0.001)	(0.001)	(0.001)
Husband's education (years)		0.008		0.005
		(0.006)		(0.004)
Asset-based SES		−0.044***		−0.058***
		(0.014)		(0.014)
Child in womb: 2nd		−0.008		0.040
		(0.038)		(0.043)
Child in womb: 3rd or higher		0.028		0.019
		(0.036)		(0.039)
Woman is depressed		0.097**		0.080**
		(0.038)		(0.030)
Constant	−0.105	−0.356	−0.406	−0.630
	(0.394)	(0.411)	(0.396)	(0.415)
Observations	1021	1021	1044	1044
R^2	0.012	0.038	0.029	0.063

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of expected effort cost of investments on mothers' characteristics.

Sample: All mothers.

Table 5: Baseline model estimates of the preference and cost parameters

	Speak		Health		Social		Learn		All outcomes	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
omega_speak	0.582**	0.528**							0.234	0.192
	(0.249)	(0.241)							(0.361)	(0.340)
omega_health			0.209	0.195					0.040	0.039
			(0.265)	(0.254)					(0.275)	(0.268)
omega_social					0.401*	0.389			−0.358	−0.289
					(0.224)	(0.245)			(0.353)	(0.367)
omega_learn							0.931***	0.849***	1.003***	0.901***
							(0.229)	(0.241)	(0.333)	(0.345)
Breastfeeding is tiring	0.202	0.213	0.195	0.204	0.201	0.211	0.232*	0.240	0.232*	0.240
	(0.132)	(0.145)	(0.131)	(0.145)	(0.131)	(0.144)	(0.134)	(0.148)	(0.134)	(0.148)
Playing is tiring	−0.690***	−0.610***	−0.722***	−0.638***	−0.703***	−0.621***	−0.674***	−0.596***	−0.675***	−0.597***
	(0.185)	(0.191)	(0.180)	(0.188)	(0.179)	(0.189)	(0.180)	(0.189)	(0.183)	(0.191)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2504	2504	2504	2504	2504	2504	2504	2504	2504	2504
# mothers	626	626	626	626	626	626	626	626	626	626

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline. See Table A9 for the coefficients.

Sample: Excludes depressed mothers in the intervention group.

Table 6: Elasticities of investments to beliefs on learning and to cost of playing

Learn **Investment choice** **(change in %)**	**BF return** **(1 % increase)**	**PL return** **(1 % increase)**	**Joint investments return** **(1 % increase)**	**Not investing return** **(1 % increase)**	**Playing cost** **(1 % increase)**
Pr(No-bf, no-pl)	-0.23	-0.10	-0.12	0.28	0.06
Pr(Bf, no-pl)	0.47	-0.10	-0.12	-0.17	0.06
Pr(No-bf, pl)	-0.23	0.62	-0.12	-0.17	-0.15
Pr(Bf, pl)	-0.23	-0.10	0.62	-0.17	-0.15

Note: Predicted probabilities estimated after a multinomial logit model that evaluates the preference for developmental outcomes jointly and where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. Estimates of the model are shown in Column 10 of Table 9. BF is short for breastfeeding. PL is short for playing.

Table 7: Estimated monetary value of learning well and cost of playing

	Evaluated at mean income*	Evaluated at median income**	Proportion of monthly income
Increase of 10 pp in the probability of learning well	14,480.6	11,186.0	0.60
Increase of 10 pp in the cost of playing	-9,786.6	-7,560.0	-0.41
*Income (mean) PKR	23,948.9		
**Income (median) PKR	18,500.0		

Note: Marginal willingness to pay (MWTP) using the coefficient estimates of the preference parameter of learning well and the cost of playing from a multinomial logit model and the average of the coefficients estimates for the log of the household income (estimates shown in Table A11)

Table 8: Heterogeneity in the preference parameters

	(1) Education	(2) SES	(3) Depression
omega_speak x 1[Low charac.]	0.110	0.944*	0.101
	(0.374)	(0.511)	(0.431)
omega_speak x 1[High charac.]	0.559	−0.396	0.488
	(0.903)	(0.480)	(0.460)
omega_health x 1[Low charac.]	−0.271	−0.654	0.386
	(0.307)	(0.448)	(0.337)
omega_health x 1[High charac.]	0.818	0.597**	−0.611
	(0.704)	(0.298)	(0.399)
omega_social x 1[Low charac.]	−0.235	−0.419	−0.264
	(0.433)	(0.573)	(0.496)
omega_social x 1[High charac.]	−0.569	−0.095	−0.472
	(0.752)	(0.537)	(0.771)
omega_learn x 1[Low charac.]	0.846**	0.712	0.563
	(0.395)	(0.554)	(0.469)
omega_learn x 1[High charac.]	1.383*	0.870*	1.651***
	(0.768)	(0.470)	(0.574)
Breastfeeding is tiring x 1[Low charac.]	0.455***	0.312	0.156
	(0.163)	(0.252)	(0.199)
Breastfeeding is tiring x 1[High charac.]	−0.412	0.146	0.513**
	(0.302)	(0.206)	(0.212)
Playing is tiring x 1[Low charac.]	−0.439*	−0.845***	−0.450*
	(0.229)	(0.219)	(0.248)
Playing is tiring x 1[High charac.]	−1.043**	−0.423	−0.973**
	(0.421)	(0.258)	(0.437)
Controls	Yes	Yes	Yes
p-value: omega_speak[Low charac.] = omega_speak[High charac.]	0.638	0.062	0.537
p-value: omega_health[Low charac.] = omega_health[High charac.]	0.172	0.016	0.050
p-value: omega_social[Low charac.] = omega_social[High charac.]	0.716	0.695	0.841
p-value: omega_learn[Low charac.] = omega_learn[High charac.]	0.529	0.826	0.169
p-value: Bf Tiring[Low charac.] = Bf Tiring[High charac.]	0.012	0.636	0.219
p-value: Pl Tiring[Low charac.] = Pl Tiring[High charac.]	0.228	0.156	0.346
Observations	2504	2504	2504
# mothers	626	626	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline. Column (1) interacts beliefs and costs with education level (high characteristic = +10 years of education). Column (2) interacts beliefs and costs with SES level (high characteristic = SES above median). Column (3) interacts beliefs and costs by depression status (high characteristic = depressed).

Sample: Excludes depressed mothers in the intervention group.

Table 9: Model estimates of the preference and cost parameters with alternative measures of maternal play

	HOME Score				Stimulation Score				PCA Stimulation items			
	(1) Learn	(2) Learn	(3) All outcomes	(4) All outcomes	(5) Learn	(6) Learn	(7) All outcomes	(8) All outcomes	(9) Learn	(10) Learn	(11) All outcomes	(12) All outcomes
omega_speak			0.138	0.104			0.097	0.100			−0.153	−0.159
			(0.334)	(0.310)			(0.335)	(0.320)			(0.363)	(0.354)
omega_health			−0.144	−0.154			0.132	0.126			0.143	0.152
			(0.270)	(0.277)			(0.243)	(0.254)			(0.276)	(0.282)
omega_social			−0.303	−0.301			−0.334	−0.342			−0.118	−0.094
			(0.349)	(0.362)			(0.378)	(0.393)			(0.363)	(0.370)
omega_learn	0.576**	0.505**	0.720*	0.666*	0.602***	0.602**	0.710**	0.715*	0.693***	0.670***	0.811**	0.773*
	(0.226)	(0.251)	(0.372)	(0.385)	(0.232)	(0.249)	(0.358)	(0.377)	(0.224)	(0.239)	(0.378)	(0.396)
Breastfeeding is tiring	0.205	0.213	0.205	0.214	0.202	0.212	0.202	0.212	0.206	0.224	0.207	0.225
	(0.134)	(0.148)	(0.134)	(0.148)	(0.137)	(0.150)	(0.138)	(0.151)	(0.136)	(0.152)	(0.137)	(0.153)
Playing is tiring	−0.490**	−0.346	−0.495**	−0.353*	−0.502***	−0.447***	−0.506***	−0.450***	−0.396**	−0.340*	−0.403**	−0.344**
	(0.198)	(0.211)	(0.198)	(0.211)	(0.149)	(0.164)	(0.148)	(0.164)	(0.165)	(0.174)	(0.164)	(0.174)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2504	2504	2504	2504	2504	2504	2504	2504	2504	2504	2504	2504
# mothers	626	626	626	626	626	626	626	626	626	626	626	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline. A mother is considered to be making the playing investment when she scores in the top tertile of: the HOME Score (Columns 1 to 4), the Stimulation Score (Responsivity + Involvement score) (Columns 5 to 8), or the first principal component (PCA) of the Stimulation items (Responsivity and Involvement items) (Columns 9 to 12).

Sample: Excludes depressed mothers in the intervention group.

Table 10: Policy Simulations

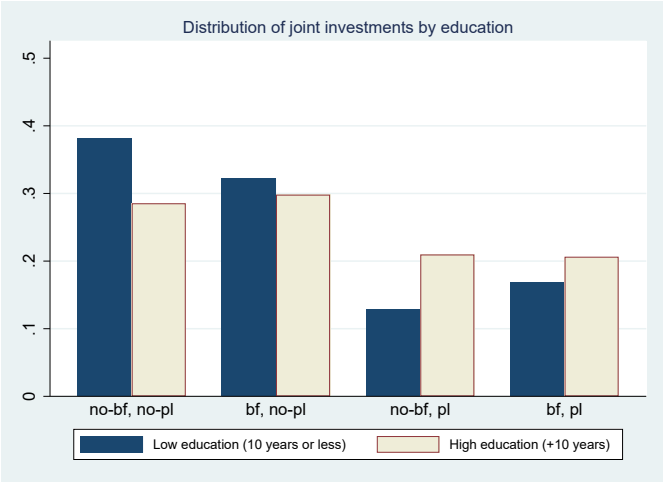
	(0) Baseline Predicted	(1) High SES beliefs	(2) Increase returns (v1)	(3) Increase returns (v2)	(4) Playing not costly	(5) 2 + 4	(6) 3 + 4	(7) Treat depression	(8) Educate women
Pr(No-bf, no-pl)	36.6	36.2	34.8	28.5	34.5	32.8	26.8	34.9	33.6
Pr(Bf, no-pl)	32.0	32.1	32.9	36.2	30.2	31.0	33.9	31.2	32.7
Pr(No-bf, pl)	14.3	14.5	14.7	16.0	16.0	16.4	17.8	14.8	17.4
Pr(Bf, pl)	17.1	17.3	17.6	19.2	19.3	19.8	21.6	19.1	16.3
Pr(Bf)	49.1	49.4	50.5	55.5	49.5	50.8	55.5	50.3	49.0
Pr(Pl)	31.4	31.7	32.3	35.3	35.3	36.2	39.4	33.9	33.7
Δ Pr(No-bf, no-pl)	**0.0**	**-0.4**	**-1.8**	**-8.0**	**-2.0**	**-3.8**	**-9.8**	**-1.6**	**-3.0**
Δ Pr(Bf)	**0.0**	**0.2**	**1.4**	**6.3**	**0.4**	**1.7**	**6.3**	**1.1**	**-0.1**
Δ Pr(Pl)	**0.0**	**0.3**	**0.9**	**3.8**	**3.8**	**4.8**	**7.9**	**2.5**	**2.2**

Note: Predicted probabilities estimated after a multinomial logit model where the preference parameters for children's developmental outcomes are evaluated jointly and where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. Col (0) - Baseline predicted probabilities; Col (1) - Low SES mothers have the beliefs held by the high SES mothers; Col (2) - The probability of children achieving developmental outcomes is increased by 10 pp. Col (3) - The probability of children achieving developmental outcomes is increased by the IQR of the average expected return of single investments (average increase of 43 pp); Col (4) - The effort cost of playing is suppressed; Col (5) - Combines Col (2) and Col (4); Col (6) - Combines Col (3) and Col (4); Col (7) - Depression status is changed to not depressed, and beliefs and costs are set at the value that not depressed mothers have; Col (8) - Education level is set at +10 years of education, and beliefs and costs are set at the value that mothers with +10 years of education have.

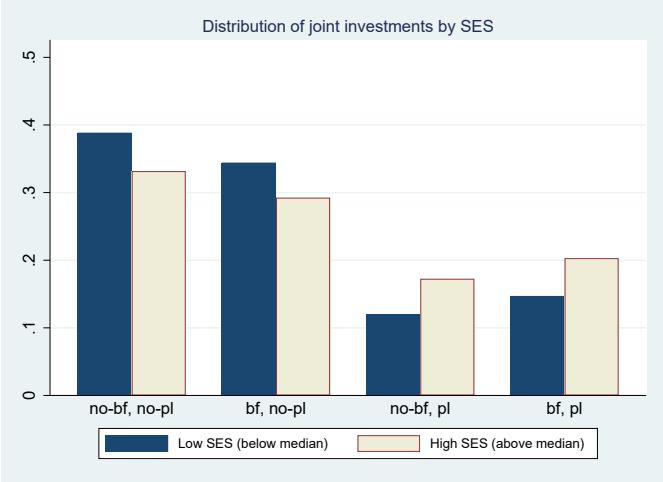
A Appendix Figures and Tables

Figure A1: Joint investments by characteristics

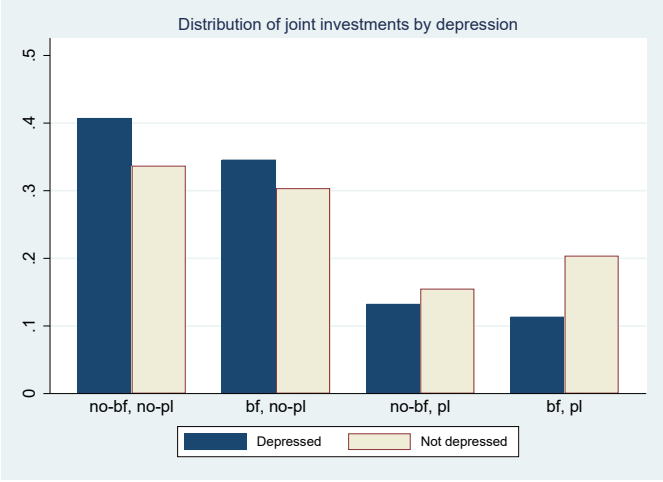
(a) By education



(b) By SES



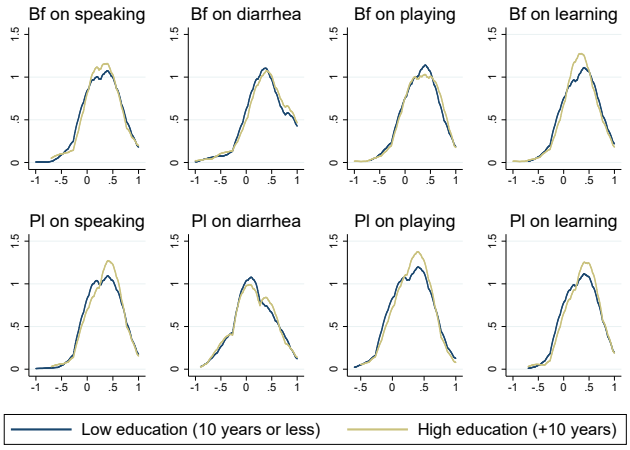
(c) By depression



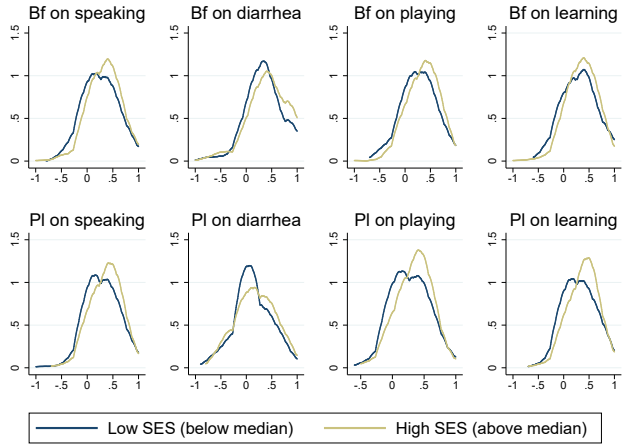
Note: Joint investments: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing

Figure A2: Expected returns by characteristics

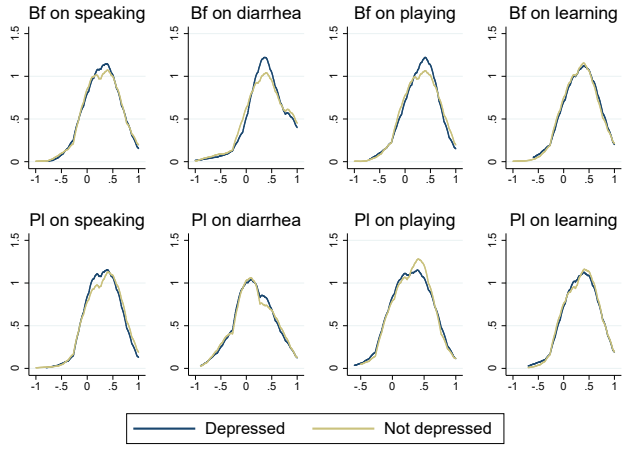
(a) By education



(b) By SES

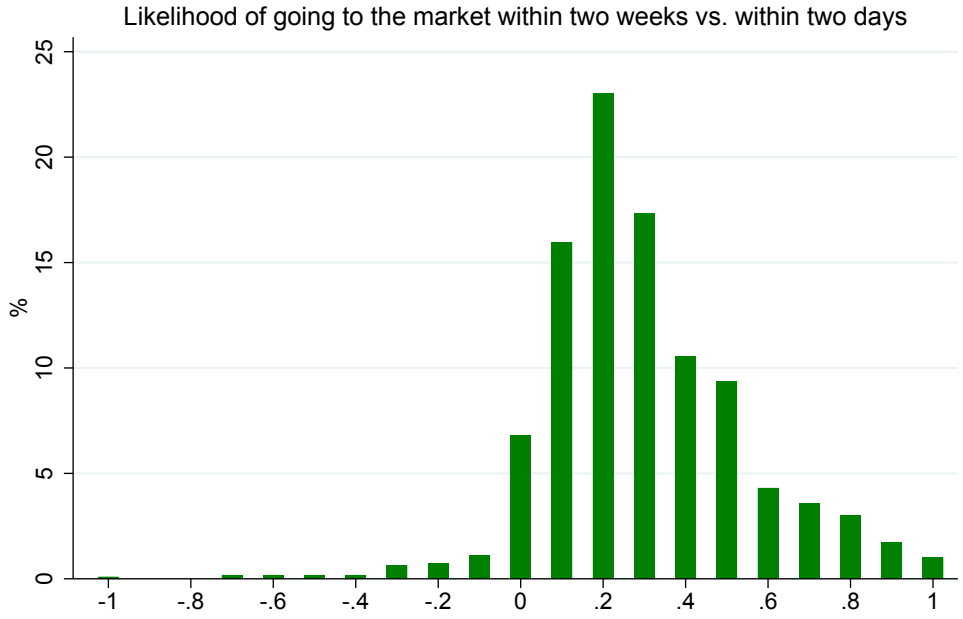


(c) By depression



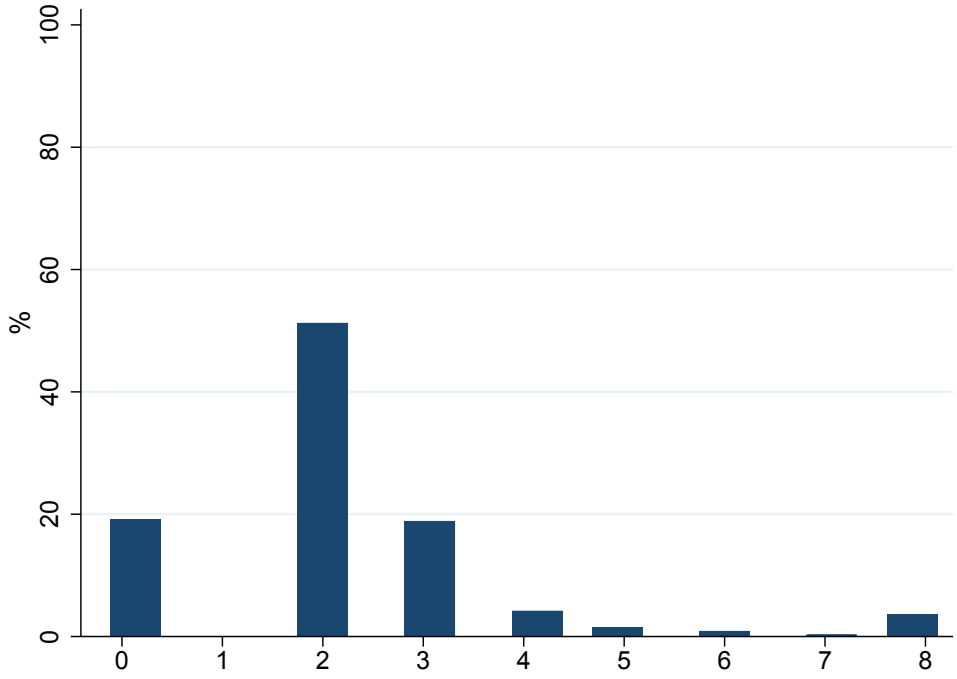
Note: Kernel distribution of individual differences in the subjective probability of children achieving developmental outcomes when a mother makes the high level investment versus when a mother makes the low level investment. Bf is short for breastfeeding. Pl is short for playing.

Figure A3: Test question. Monotonicity property of probability distributions



Note: Individual differences in the probability that a woman would go to the market within the next two weeks versus the probability a woman would go to the market within the next two days. Negative values violate the monotonicity property.

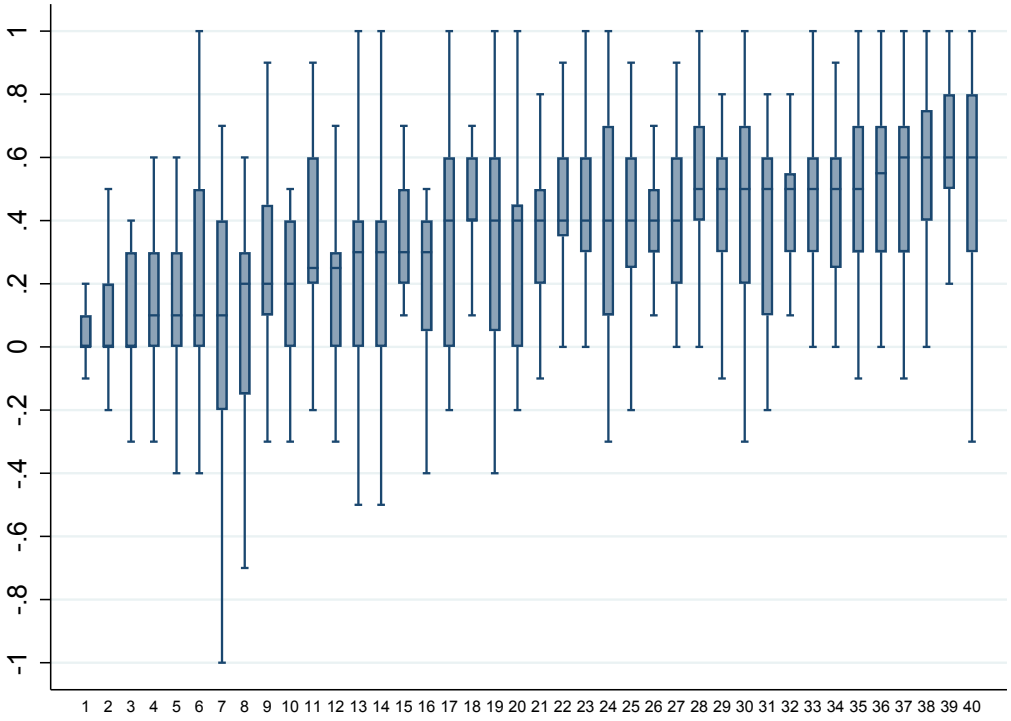
Figure A4: Individual distribution of repeated beliefs



Note: Incidence of repeated combinations of beliefs from low and high investment levels across the different developmental outcomes considered.

Figure A5: Between and within village variation in beliefs, investments, and costs

(a) Variation in beliefs: Expected return of breastfeeding on learning



(b) Variation in investments and costs

SD	Exclusively breastfeeding	Playing	Breastfeeding is tiring	Playing is tiring
Overall	0.500	0.468	0.492	0.485
Between	0.152	0.177	0.156	0.196
Within	0.482	0.445	0.471	0.446
Observations	662	662	1021	1044
Clusters	40	40	40	40

Note: (a) Box plot (excluding outliers) of the expected return of breastfeeding on learning well in each of the 40 villages under study.
(b) Within and between village variation in breastfeeding and playing practices, and costs, in the villages under study.

Table A1: Attrition at month 3

	(1) No attrited	(2) Attrited	(3) Diff
Mothers' age (years)	26.59	26.85	−0.27
Mother's education (years)	8.05	7.97	0.08
Husband's education (years)	8.92	8.83	0.09
Parity	2.49	2.35	0.14
Household's income (US dollars)	229.64	214.31	15.33
Mother normally works	0.06	0.06	−0.00
High SES (above median)	0.55	0.56	−0.01
Likelihood of putting 2-3 words in speaking by age 2			
If the mother exclusively breastfeeds for 6 months	0.70	0.68	0.02
If the mother does not exclusively breastfeed for 6 months	0.39	0.40	−0.01
If the mother plays with the child frequently	0.74	0.71	0.03
If the mother plays with the child rarely	0.41	0.42	−0.02
Likelihood of diarrhea episodes			
If the mother exclusively breastfeeds for 6 months	0.24	0.30	−0.06**
If the mother does not exclusively breastfeed for 6 months	0.65	0.62	0.02
If the mother plays with the child frequently	0.35	0.34	0.01
If the mother plays with the child rarely	0.50	0.50	−0.00
Likelihood of playing happily by age 3			
If the mother exclusively breastfeeds for 6 months	0.73	0.72	0.02
If the mother does not exclusively breastfeed for 6 months	0.41	0.43	−0.02
If the mother plays with the child frequently	0.75	0.74	0.01
If the mother plays with the child rarely	0.43	0.45	−0.03
Likelihood of learning well			
If the mother exclusively breastfeeds for 6 months	0.76	0.71	0.05*
If the mother does not exclusively breastfeed for 6 months	0.41	0.42	−0.01
If the mother plays with the child frequently	0.77	0.75	0.02
If the mother plays with the child rarely	0.41	0.46	−0.04**
Costs of investments			
Breastfeeding is tiring	0.39	0.41	−0.02
Playing is tiring	0.35	0.39	−0.04
Either breastfeeding or playing is tiring	0.48	0.52	−0.03
Observations	662	209	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Feeding practices at 3 months

	(1) All mothers	(2) Breastfeeding but not exclusively	(3) Not breastfeeding
Breast milk	0.930	1.000	0.000
Ghutti	0.024	0.049	0.042
Herbal water (Kehwa/Gripe water)	0.138	0.279	0.242
Water	0.094	0.192	0.149
Tea (Chai)	0.010	0.023	0.000
Formula Milk	0.178	0.321	0.544
Other animal milk (cow/goat/buffalo)	0.183	0.346	0.456
Semi solid food	0.015	0.030	0.023
Solid food	0.007	0.017	0.000
Other	0.017	0.032	0.045
Observations	662	290	46

Sample: Excludes depressed mothers in the intervention group.

Table A3: Heterogeneity in single investments

	(1) Exclusively breastfeeding	(2) Exclusively breastfeeding	(3) Playing	(4) Playing
Education: 1-5 years	0.057	0.062	0.054	0.016
	(0.051)	(0.051)	(0.072)	(0.071)
Education: 6-10 years	0.004	−0.006	0.006	−0.089
	(0.048)	(0.054)	(0.060)	(0.073)
Education: +10 years	0.027	0.016	0.133*	−0.018
	(0.057)	(0.072)	(0.067)	(0.093)
Age (years)	0.056	0.037	0.037	0.054
	(0.041)	(0.045)	(0.039)	(0.041)
Age squared	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Index child is female	−0.013	−0.012	−0.000	−0.006
	(0.036)	(0.037)	(0.033)	(0.033)
Husband's education (years)		−0.001		0.006
		(0.008)		(0.006)
Asset-based SES		0.014		0.031**
		(0.016)		(0.015)
Child in womb: 2nd		0.111*		−0.033
		(0.058)		(0.054)
Child in womb: 3rd or higher		0.083		−0.111*
		(0.055)		(0.062)
Woman is depressed		−0.051		−0.088**
		(0.043)		(0.040)
Constant	−0.305	−0.066	−0.214	−0.406
	(0.551)	(0.621)	(0.511)	(0.550)
Observations	662	662	662	662
R^2	0.005	0.015	0.015	0.044

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of single investments on mothers characteristics.

Sample: Excludes depressed mothers in the intervention group.

Table A4a: Heterogeneity in expected returns from breastfeeding: Different depression measures

	(1) Bf on speaking	(2) Bf on speaking	(3) Bf on speaking	(4) Bf on diarrhea	(5) Bf on diarrhea	(6) Bf on diarrhea	(7) Bf on social	(8) Bf on social	(9) Bf on social	(10) Bf on learning	(11) Bf on learning	(12) Bf on learning
Education: 1-5 years	0.078**	0.078**	0.078**	0.087*	0.087*	0.087*	0.080**	0.080**	0.080**	0.100**	0.100**	0.099**
	(0.037)	(0.037)	(0.037)	(0.045)	(0.045)	(0.045)	(0.039)	(0.039)	(0.039)	(0.037)	(0.037)	(0.037)
Education: 6-10 years	0.047	0.046	0.048	0.112***	0.110***	0.111***	0.060	0.060	0.062	0.054	0.053	0.055
	(0.032)	(0.031)	(0.032)	(0.040)	(0.040)	(0.040)	(0.042)	(0.041)	(0.042)	(0.039)	(0.038)	(0.038)
Education: +10 years	0.027	0.026	0.029	0.084*	0.082*	0.085*	0.055	0.055	0.059	0.025	0.025	0.028
	(0.037)	(0.036)	(0.037)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.039)	(0.038)	(0.039)
Age (years)	0.015	0.014	0.017	0.022	0.020	0.022	0.004	0.004	0.007	0.026	0.025	0.027
	(0.022)	(0.022)	(0.022)	(0.027)	(0.027)	(0.027)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Age squared	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.001	−0.001	−0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Husband's education (years)	0.001	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.002	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Asset-based SES	0.024***	0.024***	0.026***	0.016	0.016	0.017	0.016*	0.017**	0.019**	0.016*	0.015*	0.017*
	(0.008)	(0.008)	(0.008)	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Child in womb: 2nd	0.027	0.027	0.027	0.011	0.012	0.011	0.039	0.038	0.037	0.037	0.038	0.037
	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)	(0.030)	(0.030)	(0.030)	(0.027)	(0.027)	(0.027)
Child in womb: 3rd or higher	0.040	0.040	0.036	−0.012	−0.011	−0.015	0.079**	0.076**	0.071**	0.044	0.044	0.039
	(0.032)	(0.033)	(0.032)	(0.038)	(0.037)	(0.038)	(0.031)	(0.032)	(0.032)	(0.033)	(0.033)	(0.034)
Depression score, 8 cut-off	0.012			0.028			−0.002			0.015		
	(0.020)			(0.025)			(0.023)			(0.023)		
Depression score, 15 cut-off		0.018			0.024			0.024			0.022	
		(0.022)			(0.023)			(0.020)			(0.024)	
Depression score (baseline)			0.003*			0.003			0.003*			0.003*
			(0.001)			(0.002)			(0.002)			(0.002)
Constant	0.036	0.046	−0.001	−0.076	−0.049	−0.093	0.222	0.210	0.157	−0.054	−0.042	−0.092
	(0.319)	(0.317)	(0.322)	(0.373)	(0.370)	(0.373)	(0.277)	(0.267)	(0.278)	(0.270)	(0.263)	(0.271)
Observations	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090
R^2	0.020	0.020	0.022	0.022	0.021	0.023	0.019	0.020	0.022	0.020	0.020	0.022

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of expected returns from breastfeeding on mothers' characteristics. Bf on speaking = Expected return from breastfeeding on the probability that a child puts 2-3 together in speaking by age 2; Bf on diarrhea = Expected return from breastfeeding on the probability of lower incidence of diarrhea episodes; Bf on social = Expected return from breastfeeding on the probability that a child plays happily with other children by age 3; Bf on learning = Expected return from breastfeeding on the probability of a child learning well. Depression score is calculated using the patient health questionnaire (PHQ-9), and its value ranges from 0 to 27, where a higher score indicates a higher presence of depression symptoms.

Sample: All mothers.

Table A4b: Heterogeneity in expected returns from playing: Different depression measures

	(1) Pl on speaking	(2) Pl on speaking	(3) Pl on speaking	(4) Pl on diarrhea	(5) Pl on diarrhea	(6) Pl on diarrhea	(7) Pl on social	(8) Pl on social	(9) Pl on social	(10) Pl on learning	(11) Pl on learning	(12) Pl on learning
Education: 1-5 years	0.092**	0.092**	0.092**	0.081	0.081	0.081	0.056	0.056	0.056	0.061	0.062	0.061
	(0.038)	(0.038)	(0.038)	(0.050)	(0.051)	(0.051)	(0.041)	(0.041)	(0.041)	(0.043)	(0.043)	(0.043)
Education: 6-10 years	0.080*	0.079*	0.080*	0.036	0.038	0.037	0.058	0.057	0.058	0.036	0.034	0.036
	(0.040)	(0.040)	(0.040)	(0.041)	(0.041)	(0.041)	(0.040)	(0.040)	(0.040)	(0.041)	(0.041)	(0.041)
Education: +10 years	0.055	0.054	0.056	0.019	0.021	0.020	0.025	0.025	0.027	0.036	0.034	0.038
	(0.043)	(0.043)	(0.043)	(0.052)	(0.052)	(0.052)	(0.045)	(0.044)	(0.044)	(0.049)	(0.048)	(0.048)
Age (years)	0.060***	0.059***	0.061***	0.001	0.002	0.002	0.023	0.023	0.025	0.030	0.029	0.031*
	(0.019)	(0.020)	(0.019)	(0.025)	(0.025)	(0.026)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Age squared	−0.001***	−0.001***	−0.001***	0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.001*	−0.001*	−0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Husband's education (years)	−0.002	−0.002	−0.002	0.007*	0.007*	0.007*	0.003	0.003	0.003	0.001	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Asset-based SES	0.030***	0.029***	0.030***	−0.001	0.000	0.000	0.018**	0.018**	0.019**	0.022***	0.021***	0.023***
	(0.007)	(0.007)	(0.007)	(0.012)	(0.011)	(0.012)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Child in womb: 2nd	0.072***	0.072***	0.072***	−0.028	−0.029	−0.029	0.056**	0.056**	0.055**	0.029	0.030	0.029
	(0.021)	(0.021)	(0.021)	(0.030)	(0.030)	(0.030)	(0.025)	(0.025)	(0.025)	(0.028)	(0.029)	(0.028)
Child in womb: 3rd or higher	0.035	0.035	0.033	−0.021	−0.021	−0.022	0.027	0.026	0.022	0.010	0.010	0.005
	(0.025)	(0.025)	(0.025)	(0.037)	(0.037)	(0.037)	(0.028)	(0.029)	(0.028)	(0.031)	(0.032)	(0.031)
Depression score, 8 cut-off	0.014			−0.021			0.009			0.024		
	(0.018)			(0.021)			(0.018)			(0.019)		
Depression score, 15 cut-off		0.013			−0.015			0.013			0.021	
		(0.021)			(0.020)			(0.022)			(0.026)	
Depression score (baseline)			0.001			−0.001			0.002*			0.003**
			(0.001)			(0.002)			(0.001)			(0.001)
Constant	−0.557*	−0.545*	−0.570**	0.057	0.035	0.039	−0.063	−0.056	−0.098	−0.111	−0.087	−0.143
	(0.276)	(0.279)	(0.280)	(0.361)	(0.361)	(0.366)	(0.263)	(0.259)	(0.267)	(0.252)	(0.247)	(0.257)
Observations	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090
R^2	0.047	0.046	0.047	0.009	0.009	0.009	0.027	0.027	0.029	0.021	0.021	0.024

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of expected returns from playing with the child on mothers' characteristics. Pl on speaking = Expected return from playing on the probability that a child puts 2-3 together in speaking by age 2; Pl on diarrhea = Expected return from playing on the probability of lower incidence of diarrhea episodes; Pl on social = Expected return from playing on the probability that a child plays happily with other children by age 3; Pl on learning = Expected return from playing on the probability of a child learning well. Depression score is calculated using the patient health questionnaire (PHQ-9), and its value ranges from 0 to 27, where a higher score indicates a higher presence of depression symptoms.

Sample: All mothers.

Table A5: Mother's characteristics and expected zero returns

	(1) Only one expected null return	(2) Two to three expected null returns	(3) Four to eight expected null returns	(4) More than one expected negative returns
Education: 1-5 years	0.026	−0.028	−0.060*	−0.112**
	(0.040)	(0.033)	(0.032)	(0.052)
Education: 6-10 years	−0.038	0.041	−0.067*	−0.046
	(0.036)	(0.033)	(0.035)	(0.052)
Education: +10 years	−0.032	0.055	−0.065	−0.007
	(0.051)	(0.043)	(0.038)	(0.059)
Age (years)	0.010	−0.013	−0.002	−0.040
	(0.031)	(0.022)	(0.020)	(0.028)
Age squared	−0.000	0.000	0.000	0.001
	(0.001)	(0.000)	(0.000)	(0.001)
Husband's education (years)	0.004	−0.004	−0.004	−0.004
	(0.003)	(0.004)	(0.003)	(0.006)
Asset-based SES	−0.002	−0.033***	−0.008	−0.032***
	(0.010)	(0.008)	(0.008)	(0.011)
Child in womb: 2nd	0.013	−0.011	−0.022	−0.010
	(0.036)	(0.023)	(0.026)	(0.036)
Child in womb: 3rd or higher	−0.008	−0.024	−0.026	−0.032
	(0.038)	(0.024)	(0.029)	(0.032)
Woman is depressed	−0.003	−0.015	−0.036	−0.011
	(0.029)	(0.021)	(0.023)	(0.021)
Constant	0.013	0.309	0.252	0.844**
	(0.415)	(0.281)	(0.278)	(0.371)
Mean depvar	0.190	0.130	0.107	0.215
Observations	1090	1090	1090	1090
R^2	0.005	0.024	0.014	0.025

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of the incidence of expected null returns from investments on mothers' characteristics (Columns 1 to 3), and of the incidence of expected negative returns on mothers' characteristics (Column 4).

Sample: All mothers.

Table A6: Calibration of beliefs

In sample expected likelihood of frequent diarrhea episodes	%
If the mother exclusively breastfeeds for 6 months	25.2
If the mother does not exclusively breastfeed for 6 months	64.4
If the mother plays with the child frequently	35.3
If the mother plays with the child rarely	51.0

Proportion of children with diarrhea in the last 2 weeks according to 2012-2013 Pakistan DHS	%
$<$ 6 months old	25.8
6-11 months old	35.3
12-23 months old	32.9

In sample expected likelihood of putting 2-3 words together by age 2	%
If the mother exclusively breastfeeds for 6 months	69.8
If the mother does not exclusively breastfeed for 6 months	39.5
If the mother plays with the child frequently	74.1
If the mother plays with the child rarely	41.5

Proportion of children that speak partial sentences by age 2	%
In the US according to Cunha (2016)	80.0

Table A7: Effort cost by characteristics

	Education		**SES**		**Depression**	
	Low	High	Low	High	Yes	No
Breastfeeding is tiring						
Rarely or never	0.566	0.609	0.510	0.634	0.486	0.617
Sometimes	0.267	0.226	0.301	0.219	0.296	0.239
Most of the time	0.113	0.086	0.131	0.085	0.146	0.088
Don't know	0.054	0.079	0.058	0.062	0.071	0.055
Playing is tiring						
Rarely or never	0.603	0.677	0.523	0.706	0.527	0.663
Sometimes	0.248	0.189	0.292	0.183	0.271	0.217
Most of the time	0.112	0.093	0.133	0.086	0.150	0.088
Don't know	0.037	0.041	0.053	0.025	0.053	0.031
Observations	854	236	548	542	547	543

Note: Low education = 10 years or less of education. High education = + 10 years of education. Low SES = SES asset-based index below the median. High SES = SES asset-based index above the median. Depressed = PHQ-9 questionnaire score 10 or above. Not depressed = PHQ-9 questionnaire score below 10.

Sample: All mothers.

Table A8: Correlation of beliefs and costs

	(1) Bf on speaking	(2) Bf on speaking	(3) Bf on diarrhea	(4) Bf on diarrhea	(5) Bf on social	(6) Bf on social	(7) Bf on learning	(8) Bf on learning	(9) Pl on speaking	(10) Pl on speaking	(11) Pl on diarrhea	(12) Pl on diarrhea	(13) Pl on social	(14) Pl on social	(15) Pl on learning	(16) Pl on learning
Bf sometimes tiring	0.111***	0.104***	0.052	0.038	0.121***	0.119***	0.103***	0.103***								
	(0.032)	(0.029)	(0.044)	(0.043)	(0.036)	(0.036)	(0.031)	(0.030)								
Bf most of the times tiring	0.080**	0.080**	0.056	0.052	0.071*	0.074**	0.028	0.030								
	(0.038)	(0.037)	(0.050)	(0.049)	(0.036)	(0.036)	(0.034)	(0.034)								
Pl sometimes tiring									0.097**	0.093**	0.169***	0.159***	0.153***	0.147***	0.193***	0.190***
									(0.042)	(0.044)	(0.035)	(0.034)	(0.030)	(0.029)	(0.035)	(0.034)
Pl most of the times tiring									0.058	0.057	0.057	0.056	0.032	0.030	0.035	0.034
									(0.047)	(0.048)	(0.040)	(0.041)	(0.040)	(0.041)	(0.045)	(0.045)
Education: 1-5 years		0.072*		0.084*		0.073*		0.093**		0.071		0.073**		0.038		0.040
		(0.037)		(0.044)		(0.038)		(0.036)		(0.052)		(0.036)		(0.039)		(0.042)
Education: 6-10 years		0.039		0.109**		0.051		0.046		0.029		0.060		0.038		0.012
		(0.030)		(0.041)		(0.039)		(0.036)		(0.041)		(0.036)		(0.037)		(0.036)
Education: +10 years		0.022		0.081*		0.050		0.020		0.016		0.042		0.012		0.018
		(0.034)		(0.044)		(0.041)		(0.037)		(0.050)		(0.038)		(0.040)		(0.044)
Age (years)		0.013		0.022		0.002		0.026		0.005		0.063***		0.027		0.036*
		(0.024)		(0.027)		(0.021)		(0.021)		(0.025)		(0.020)		(0.019)		(0.018)
Age squared		−0.000		−0.000		−0.000		−0.001		−0.000		−0.001***		−0.001		−0.001**
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Husband's education (years)		0.001		0.002		0.001		0.002		0.007*		−0.001		0.003		0.002
		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)		(0.004)		(0.003)		(0.004)
Asset-based SES		0.022***		0.017*		0.014		0.012		−0.003		0.019***		0.008		0.010
		(0.007)		(0.010)		(0.009)		(0.009)		(0.011)		(0.007)		(0.008)		(0.008)
Child in womb: 2nd		0.019		0.011		0.027		0.029		−0.035		0.062***		0.048*		0.023
		(0.025)		(0.027)		(0.032)		(0.027)		(0.030)		(0.021)		(0.025)		(0.030)
Child in womb: 3rd or higher		0.036		−0.011		0.072**		0.040		−0.029		0.025		0.017		0.001
		(0.031)		(0.039)		(0.032)		(0.033)		(0.036)		(0.024)		(0.028)		(0.030)
Woman is depressed		0.021		0.036		0.018		0.027		0.012		0.019		0.019		0.032
		(0.021)		(0.025)		(0.021)		(0.023)		(0.018)		(0.019)		(0.019)		(0.022)
Constant	0.220***	−0.007	0.344***	−0.112	0.233***	0.164	0.272***	−0.111	0.085**	−0.066	0.219***	−0.683**	0.220***	−0.193	0.227***	−0.294
	(0.032)	(0.347)	(0.043)	(0.378)	(0.037)	(0.283)	(0.030)	(0.272)	(0.033)	(0.357)	(0.032)	(0.280)	(0.028)	(0.276)	(0.033)	(0.250)
Observations	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090
R^2	0.016	0.032	0.002	0.024	0.022	0.038	0.020	0.037	0.010	0.018	0.073	0.102	0.075	0.089	0.090	0.100

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated with an OLS regression of expected returns from investments on the expected effort cost of investments and mothers characteristics. Bf on speaking = Expected return from breastfeeding on the probability that a child puts 2-3 together in speaking by age 2; Bf on diarrhea = Expected return from breastfeeding on the probability of lower incidence of diarrhea episodes; Bf on social = Expected return from breastfeeding on the probability that a child plays happily with other children by age 3; Bf on learning = Expected return from breastfeeding on the probability of a child learning well. Pl on speaking = Expected return from playing on the probability that a child puts 2-3 together in speaking by age 2; Pl on diarrhea = Expected return from playing on the probability of lower incidence of diarrhea episodes; Pl on social = Expected return from playing on the probability that a child plays happily with other children by age 3; Pl on learning = Expected return from playing on the probability of a child learning well.

Sample: All mothers.

Table A9: Baseline model estimates of the effect of characteristics on the choice of investments

	(1) Speak	(2) Health	(3) Social	(4) Learn	(5) All outcomes
bf, no-pl					
Education: 1-5 years	0.345	0.380	0.346	0.308	0.318
	(0.300)	(0.302)	(0.303)	(0.304)	(0.308)
Education: 6-10 years	0.195	0.219	0.189	0.168	0.180
	(0.280)	(0.281)	(0.283)	(0.285)	(0.295)
Education: +10 years	0.350	0.387	0.342	0.314	0.331
	(0.304)	(0.300)	(0.317)	(0.315)	(0.331)
Child in womb: 2nd	0.202	0.214	0.206	0.168	0.167
	(0.324)	(0.321)	(0.321)	(0.327)	(0.331)
Child in womb: 3rd or higher	0.134	0.158	0.125	0.104	0.116
	(0.237)	(0.234)	(0.240)	(0.227)	(0.233)
Index child is female	−0.019	−0.040	−0.033	−0.030	−0.028
	(0.163)	(0.163)	(0.161)	(0.163)	(0.165)
Age (years)	0.164	0.180	0.179	0.158	0.152
	(0.259)	(0.255)	(0.260)	(0.261)	(0.258)
Age squared	−0.003	−0.003	−0.003	−0.003	−0.002
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Asset-based SES	−0.002	0.004	−0.001	−0.000	0.001
	(0.095)	(0.094)	(0.094)	(0.093)	(0.094)
Husband's education (years)	−0.016	−0.017	−0.015	−0.015	−0.016
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Woman is depressed	−0.093	−0.088	−0.092	−0.086	−0.084
	(0.187)	(0.192)	(0.190)	(0.186)	(0.184)
no-bf, pl					
Education: 1-5 years	0.032	0.064	0.037	−0.005	0.001
	(0.533)	(0.532)	(0.534)	(0.538)	(0.537)
Education: 6-10 years	−0.365	−0.341	−0.368	−0.384	−0.374
	(0.532)	(0.528)	(0.534)	(0.535)	(0.535)
Education: +10 years	0.173	0.189	0.155	0.128	0.144
	(0.554)	(0.553)	(0.557)	(0.560)	(0.555)
Child in womb: 2nd	−0.568	−0.528	−0.551	−0.546	−0.544
	(0.369)	(0.371)	(0.370)	(0.373)	(0.366)
Child in womb: 3rd or higher	−1.108***	−1.076***	−1.104***	−1.094***	−1.086***
	(0.349)	(0.353)	(0.352)	(0.358)	(0.350)
Index child is female	0.087	0.069	0.078	0.072	0.072
	(0.263)	(0.262)	(0.262)	(0.263)	(0.262)
Age (years)	0.242	0.283	0.281	0.242	0.225
	(0.347)	(0.346)	(0.347)	(0.349)	(0.345)
Age squared	−0.003	−0.004	−0.004	−0.003	−0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Asset-based SES	0.073	0.084	0.082	0.074	0.070
	(0.106)	(0.105)	(0.107)	(0.105)	(0.103)
Husband's education (years)	0.003	0.002	0.002	0.005	0.006
	(0.055)	(0.055)	(0.055)	(0.055)	(0.056)
Woman is depressed	−0.230	−0.221	−0.228	−0.227	−0.226
	(0.254)	(0.256)	(0.257)	(0.259)	(0.258)
bf, pl					
Education: 1-5 years	−0.097	−0.070	−0.090	−0.134	−0.132
	(0.388)	(0.390)	(0.390)	(0.389)	(0.392)
Education: 6-10 years	−0.613	−0.600	−0.618	−0.631	−0.622
	(0.422)	(0.428)	(0.419)	(0.420)	(0.429)
Education: +10 years	−0.378	−0.360	−0.390	−0.403	−0.389
	(0.523)	(0.517)	(0.519)	(0.524)	(0.529)
Child in womb: 2nd	0.331	0.348	0.331	0.322	0.326
	(0.343)	(0.341)	(0.342)	(0.345)	(0.346)
Child in womb: 3rd or higher	−0.064	−0.042	−0.081	−0.064	−0.044
	(0.384)	(0.383)	(0.382)	(0.381)	(0.379)
Index child is female	−0.033	−0.058	−0.048	−0.046	−0.042
	(0.205)	(0.203)	(0.204)	(0.204)	(0.205)
Age (years)	0.322	0.350	0.354	0.314	0.299
	(0.280)	(0.275)	(0.275)	(0.279)	(0.280)
Age squared	−0.006	−0.006	−0.006	−0.005	−0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Asset-based SES	0.201**	0.214**	0.208**	0.203**	0.202**
	(0.100)	(0.101)	(0.100)	(0.100)	(0.100)
Husband's education (years)	0.022	0.022	0.022	0.024	0.024
	(0.048)	(0.048)	(0.048)	(0.048)	(0.047)
Woman is depressed	−0.563*	−0.557*	−0.567*	−0.575*	−0.570*
	(0.297)	(0.296)	(0.298)	(0.302)	(0.301)
Observations	2504	2504	2504	2504	2504
# mothers	626	626	626	626	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). Speak = when estimating the preference parameter for a child being able to put 2-3 words together in speaking by age 2. Health = when estimating the preference parameter for a child not experiencing frequent diarrhea. Social = when estimating the preference parameter for a child playing happily with other children by age 3. Learn = when estimating the preference parameter for a child learning well at school. All outcomes = when estimating all preference parameters simultaneously. Other coefficients are presented in Table 5.

Sample: Excludes depressed mothers in the intervention group.

Table A10: Goodness of fit: Observed and predicted distribution of investments

	All mothers		**Depressed**		**Low educated**		**Low SES**		**At least two expected 0 returns**		**Any investment has high cost**	
	Observed	Predicted	Observed	Predicted	Observed	Predicted	Observed	Predicted	Observed	Predicted	Observed	Predicted
Pr(No-bf, no-pl)	36.56	36.56	41.18	41.18	38.53	38.53	40.11	40.05	42.78	42.32	34.18	39.92
Pr(Bf, no-pl)	32.00	32.00	34.80	34.80	32.91	32.91	35.11	34.64	31.93	30.84	38.95	36.48
Pr(No-bf, pl)	14.30	14.30	12.25	12.25	12.34	12.34	10.80	11.82	10.25	12.53	9.43	9.76
Pr(Bf, pl)	17.14	17.14	11.76	11.76	16.22	16.22	13.98	13.48	15.04	14.30	17.45	13.83
Pr(Bf)	**49.14**	**49.14**	**46.57**	**46.57**	**49.13**	**49.13**	**49.09**	**48.13**	**46.97**	**45.15**	**56.40**	**50.32**
Pr(Pl)	**31.44**	**31.44**	**24.02**	**24.02**	**28.56**	**28.56**	**24.78**	**25.30**	**25.29**	**26.83**	**26.88**	**23.60**

Note: Observed and predicted probabilities estimated after a multinomial logit model where the preference parameters for children's developmental outcomes are evaluated jointly and where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. Depressed = PHQ-9 questionnaire score 10 or above. Low educated = 10 years or less of education. Low SES = SES asset-based index below the median.

Table A11: Model estimates of the cost and preference parameters using income

		bf, no-pl	**no-bf, pl**	**bf, pl**
omega_speak	0.255			
	(0.334)			
omega_health	0.026			
	(0.269)			
omega_social	−0.304			
	(0.362)			
omega_learn	0.893***			
	(0.337)			
Breastfeeding is tiring	0.256*			
	(0.152)			
Playing is tiring	−0.647***			
	(0.188)			
Education: 1-5 years		0.343	0.024	−0.037
		(0.323)	(0.541)	(0.391)
Education: 6-10 years		0.144	−0.336	−0.401
		(0.282)	(0.539)	(0.418)
Education: +10 years		0.231	0.179	−0.075
		(0.332)	(0.571)	(0.528)
Child in womb: 2nd		0.185	−0.536	0.339
		(0.328)	(0.372)	(0.346)
Child in womb: 3rd or higher		0.116	−1.079***	−0.031
		(0.229)	(0.357)	(0.386)
Index child is female		−0.035	0.075	0.004
		(0.164)	(0.264)	(0.219)
Age (years)		0.148	0.226	0.300
		(0.261)	(0.344)	(0.277)
Age squared		−0.002	−0.003	−0.005
		(0.005)	(0.006)	(0.005)
Husband's education (years)		−0.028	0.007	0.048
		(0.038)	(0.054)	(0.047)
Woman is depressed		−0.074	−0.222	−0.621**
		(0.189)	(0.254)	(0.295)
Log of hh income		0.326**	0.219	0.022
		(0.161)	(0.182)	(0.194)
Observations	2504			
# mothers	626			

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school.

Sample: Excludes depressed mothers in the intervention group.

Table A12: Mixed logit model

	(1)	(2)	(3)	(4)	(5)
omega_speak	0.489*				0.158
	(0.251)				(0.374)
omega_health		0.306			0.162
		(0.455)			(0.442)
omega_social			0.361		−0.329
			(0.248)		(0.385)
omega_learn				0.873***	1.012***
				(0.247)	(0.369)
Breastfeeding is tiring	0.201	0.202	0.200	0.231	0.243
	(0.143)	(0.152)	(0.144)	(0.147)	(0.156)
Playing is tiring	−0.599***	−0.644***	−0.608***	−0.581***	−0.606***
	(0.191)	(0.214)	(0.188)	(0.190)	(0.208)
SD					
omega_speak	0.088				0.020
	(0.125)				(0.283)
omega_health		1.210			1.258
		(2.070)			(1.921)
omega_social			0.152		0.476
			(0.381)		(1.834)
omega_learn				0.163	0.104
				(0.778)	(0.257)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	2504	2504	2504	2504	2504
# mothers	626	626	626	626	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a mixed logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, parity, mother's education in years, husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline.

Sample: Excludes depressed mothers in the intervention group.

Table A13: Heterogeneity in the preference parameters by constraint levels

	(1) Female Child	(2) Grandmother	(3) Agricultural household
omega_speak x 1[Constrained]	0.109	0.450	−0.073
	(0.575)	(0.719)	(0.524)
omega_speak x 1[No constrained]	0.240	0.097	0.515
	(0.448)	(0.403)	(0.589)
omega_health x 1[Constrained]	0.080	−0.899	0.244
	(0.403)	(0.580)	(0.339)
omega_health x 1[No constrained]	0.042	0.377	−0.107
	(0.329)	(0.319)	(0.416)
omega_social x 1[Constrained]	0.059	0.023	−0.203
	(0.689)	(0.644)	(0.535)
omega_social x 1[No constrained]	−0.519	−0.260	−0.223
	(0.397)	(0.455)	(0.721)
omega_learn x 1[Constrained]	0.651	0.996	1.456***
	(0.506)	(0.738)	(0.492)
omega_learn x 1[No constrained]	1.095**	0.750*	0.159
	(0.459)	(0.443)	(0.501)
Breastfeeding is tiring x 1[Constrained]	0.093	0.038	0.096
	(0.279)	(0.242)	(0.234)
Breastfeeding is tiring x 1[No constrained]	0.374*	0.347*	0.405*
	(0.214)	(0.193)	(0.214)
Playing is tiring x 1[Constrained]	−0.476*	−0.833**	−0.300
	(0.285)	(0.377)	(0.231)
Playing is tiring x 1[No constrained]	−0.693***	−0.529**	−1.082***
	(0.225)	(0.218)	(0.290)
Controls	Yes	Yes	Yes
p-value: omega_speak[Constr.] = omega_speak[No constr.]	0.861	0.675	0.497
p-value: omega_health[Constr.] = omega_health[No constr.]	0.938	0.061	0.506
p-value: omega_social[Constr.] = omega_social[No constr.]	0.445	0.727	0.984
p-value: omega_learn[Constr.] = omega_learn[No constr.]	0.512	0.789	0.078
p-value: Bf Tiring[Constr.] = Bf Tiring[No constr.]	0.477	0.324	0.368
p-value: Pl Tiring[Constr.] = Pl Tiring[No constr.]	0.504	0.473	0.022
Observations	2504	2504	2504
# mothers	626	626	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline. Column (1) interacts beliefs and costs with a dummy indicating whether there is an older female child in the household (constrained = no female child). Column (2) interacts beliefs and costs with a dummy indicating whether the grandmother lives in the household (constrained = grandmother not in household). Column (3) interacts beliefs and costs with a dummy indicating whether the mother lives in an agricultural household (constrained = agricultural household). A household is considered agricultural if anyone in the household owns or rents land for farming.

Sample: Excludes depressed mothers in the intervention group.

Table A14: Women with potentially no breastfeeding constraints

	(1) If had enough food	(2) If weight>10^{th} pctile.
omega_speak	0.055	0.154
	(0.380)	(0.385)
omega_health	−0.045	0.071
	(0.250)	(0.270)
omega_social	−0.211	−0.111
	(0.403)	(0.387)
omega_learn	1.003***	0.728**
	(0.348)	(0.367)
Breastfeeding is tiring	0.253	0.146
	(0.169)	(0.156)
Playing is tiring	−0.670***	−0.448**
	(0.192)	(0.195)
Controls	Yes	Yes
Observations	2216	2248
# mothers	554	562

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline.

Sample: Excludes depressed mothers in the intervention group. In addition, Column (1) excludes women that did not have enough money to by food at baseline, and Column (2) excludes women with weight equal or below the 10^{th} percentile.

Table A15: Model estimates of the preference parameters with complementarities in investments

	Speak		Health		Social		Learn		All outcomes	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Complementarity from pilot										
omega_speak	0.584**	0.531**							0.233	0.191
	(0.250)	(0.242)							(0.363)	(0.342)
omega_health			0.209	0.194					0.039	0.037
			(0.265)	(0.254)					(0.276)	(0.268)
omega_social					0.401*	0.389			−0.371	−0.303
					(0.225)	(0.245)			(0.355)	(0.369)
omega_learn							0.942***	0.861***	1.023***	0.923***
							(0.229)	(0.241)	(0.335)	(0.348)
Breastfeeding is tiring	0.203	0.213	0.195	0.204	0.201	0.211	0.233*	0.241	0.233*	0.241
	(0.132)	(0.145)	(0.131)	(0.145)	(0.131)	(0.144)	(0.134)	(0.148)	(0.134)	(0.148)
Playing is tiring	−0.690***	−0.611***	−0.722***	−0.638***	−0.703***	−0.621***	−0.674***	−0.596***	−0.675***	−0.597***
	(0.185)	(0.192)	(0.180)	(0.188)	(0.180)	(0.189)	(0.180)	(0.189)	(0.183)	(0.191)
5% complementarity										
omega_speak	0.588**	0.535**							0.230	0.188
	(0.251)	(0.242)							(0.366)	(0.345)
omega_health			0.208	0.192					0.036	0.033
			(0.265)	(0.254)					(0.276)	(0.268)
omega_social					0.400*	0.388			−0.395	−0.328
					(0.225)	(0.245)			(0.358)	(0.372)
omega_learn							0.961***	0.882***	1.059***	0.963***
							(0.229)	(0.240)	(0.340)	(0.353)
Breastfeeding is tiring	0.203	0.213	0.195	0.204	0.202	0.212	0.234*	0.242	0.234*	0.242
	(0.132)	(0.145)	(0.131)	(0.145)	(0.131)	(0.144)	(0.134)	(0.148)	(0.135)	(0.148)
Playing is tiring	−0.690***	−0.611***	−0.722***	−0.638***	−0.703***	−0.621***	−0.674***	−0.596***	−0.675***	−0.598***
	(0.185)	(0.192)	(0.180)	(0.188)	(0.180)	(0.189)	(0.181)	(0.189)	(0.184)	(0.191)
10% complementarity										
omega_speak	0.592**	0.541**							0.225	0.184
	(0.253)	(0.243)							(0.371)	(0.348)
omega_health			0.206	0.189					0.031	0.026
			(0.265)	(0.254)					(0.276)	(0.268)
omega_social					0.396*	0.384			−0.428	−0.365
					(0.225)	(0.244)			(0.361)	(0.375)
omega_learn							0.987***	0.912***	1.111***	1.020***
							(0.228)	(0.240)	(0.345)	(0.359)
Breastfeeding is tiring	0.204	0.214	0.195	0.204	0.202	0.212	0.235*	0.244	0.236*	0.244
	(0.132)	(0.145)	(0.131)	(0.145)	(0.131)	(0.144)	(0.134)	(0.149)	(0.135)	(0.149)
Playing is tiring	−0.691***	−0.611***	−0.722***	−0.638***	−0.704***	−0.622***	−0.673***	−0.596***	−0.676***	−0.599***
	(0.185)	(0.192)	(0.180)	(0.188)	(0.180)	(0.189)	(0.181)	(0.189)	(0.184)	(0.191)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	2504	2504	2504	2504	2504	2504	2504	2504	2504	2504
# mothers	626	626	626	626	626	626	626	626	626	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline. "Complementarity from pilot" defines that there is a 1.8% complementarity between investments when mothers both breastfeed and play with the child. This level of complementarity is calculated using a sample of women for which expected returns from investments where asked both jointly and independently. "5% complementarity" assumes that there is a 5% complementary between investments when mothers both breastfeed and play with the child; while "10% complementarity" assumes this level is of the order of 10%.

Sample: Excludes depressed mothers in the intervention group.

Table A16: Model estimates: Additional specifications

	(1) Including treated mothers	(2) Positive returns	(3) Negative returns set to 0	(4) Cost and enjoyment of investments	(5) First-time mothers	(6) First-time mothers	(7) Baseline model (Unweighted)
omega_speak	0.127	−0.008	0.044	0.221		0.569	0.204
	(0.333)	(0.439)	(0.354)	(0.346)		(0.729)	(0.336)
omega_health	0.100	0.211	0.302	0.078		0.252	0.012
	(0.269)	(0.323)	(0.284)	(0.272)		(0.488)	(0.267)
omega_social	−0.067	0.256	0.021	−0.269		−0.559	−0.292
	(0.340)	(0.404)	(0.411)	(0.377)		(0.753)	(0.366)
omega_learn	0.664**	0.722*	0.686**	0.939***	0.931**	0.936	0.934***
	(0.339)	(0.394)	(0.348)	(0.342)	(0.448)	(0.608)	(0.340)
Breastfeeding is tiring	0.195	0.098	0.223	0.247*	0.350	0.372	0.248*
	(0.142)	(0.186)	(0.148)	(0.147)	(0.350)	(0.346)	(0.146)
Playing is tiring	−0.540***	−0.707***	−0.605***	−0.583***	−1.013***	−0.993***	−0.610***
	(0.179)	(0.219)	(0.188)	(0.189)	(0.333)	(0.340)	(0.189)
Breastfeeding is enjoyable				−0.291			
				(0.265)			
Playing is enjoyable				−0.223			
				(0.407)			
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3352	2008	2504	2504	720	720	2504
# mothers	838	502	626	626	180	180	626

* p < 0.1, ** p < 0.05, *** p < 0.01. Robust standard errors in parenthesis, clustered at the village level.

Note: Results estimated using a multinomial logit model where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. The model includes a constant and the investment alternatives are evaluated against not breastfeeding and not playing (omitted category). omega_speak = preference parameter for a child being able to put 2-3 words together in speaking by age 2. omega_health = preference parameter for a child not experiencing frequent diarrhea. omega_social = preference parameter for a child playing happily with other children by age 3. omega_learn = preference parameter for a child learning well at school. Controls include the age of the mother and its square, the sex of the index child, 3 levels of parity (first child in womb, second, and third or higher), 4 levels of mother's education (no education, 1-5 years, 6-10 years, and +10 years), husband's education in years, a SES asset-based index, and a dummy for being diagnosed as depressed at baseline. Column (1) includes depressed mothers in the intervention group; Column (2) excludes mothers with more than one negative expected returns from investments, Column (3) assumes returns from investments cannot be negative; Column (4) considers both maternal and paternal play to evaluate the investment in children stimulation; Column (5) includes whether mothers find breastfeeding and playing with the child enjoyable in the cost function. Columns (6) and (7) show results of the baseline model (but replacing categories of education with continuous years of education) estimated only for first-time mothers. Column (8) shows the results of estimating the baseline model without weighting observations to adjust for depression prevalence.

Sample: Column (1) all mothers, Columns (2 - 5) and (8) exclude depressed mothers in the intervention group. In addition, Column (2) excludes mothers with more than one negative expected returns from investments. Columns (6) and (7) exclude women that had cared for babies of their own before.

Table A17a: Policy evaluations for different subsamples

Panel A: sample of depressed mothers (30% of women)

	(0) Baseline Predicted	(1) High SES beliefs	(2) Increase returns (v1)	(3) Increase returns (v2)	(4) Playing not costly	(5) 2 + 4	(6) 3 + 4	(7) Treat depression	(8) Educate women
Pr(No-bf, no-pl)	41.2	40.6	39.4	32.7	38.9	37.2	30.6	35.8	37.8
Pr(Bf, no-pl)	34.8	35.0	35.8	39.9	32.9	33.8	37.4	32.0	35.6
Pr(No-bf, pl)	12.3	12.5	12.5	13.9	14.3	14.6	16.1	13.9	15.5
Pr(Bf, pl)	11.8	11.9	12.2	13.5	13.9	14.4	15.8	18.3	11.0
Pr(Bf)	46.6	46.9	48.0	53.4	46.8	48.2	53.2	50.3	46.7
Pr(Pl)	24.0	24.4	24.7	27.4	28.2	29.0	31.9	32.3	26.5
Δ Pr(No-bf, no-pl)	**0.0**	**-0.6**	**-1.8**	**-8.5**	**-2.2**	**-4.0**	**-10.5**	**-5.4**	**-3.4**
Δ Pr(Bf)	**0.0**	**0.4**	**1.5**	**6.8**	**0.2**	**1.6**	**6.6**	**3.7**	**0.1**
Δ Pr(Pl)	**0.0**	**0.4**	**0.7**	**3.4**	**4.2**	**4.9**	**7.9**	**8.2**	**2.5**
Gap (Bf)	3.7	3.3	2.2	-3.2	3.5	2.1	-3.0	-0.1	3.5
Gap (Pl)	10.6	10.2	9.9	7.2	6.4	5.6	2.7	2.3	8.0

Panel B: sample of low educated mothers (76% of women)

	(0) Baseline Predicted	(1) High SES beliefs	(2) Increase returns (v1)	(3) Increase returns (v2)	(4) Playing not costly	(5) 2 + 4	(6) 3 + 4	(7) Treat depression	(8) Educate women
Pr(No-bf, no-pl)	38.5	38.0	36.7	30.2	36.4	34.7	28.4	36.6	34.6
Pr(Bf, no-pl)	32.9	33.1	33.9	37.5	31.1	31.9	35.1	32.0	33.9
Pr(No-bf, pl)	12.3	12.5	12.7	13.9	14.0	14.4	15.7	12.9	16.4
Pr(Bf, pl)	16.2	16.4	16.7	18.3	18.5	19.1	20.8	18.4	15.1
Pr(Bf)	49.1	49.5	50.6	55.8	49.6	51.0	55.9	50.5	49.0
Pr(Pl)	28.6	28.9	29.4	32.3	32.5	33.4	36.5	31.3	31.5
Δ Pr(No-bf, no-pl)	**0.0**	**-0.5**	**-1.8**	**-8.3**	**-2.1**	**-3.9**	**-10.1**	**-1.9**	**-3.9**
Δ Pr(Bf)	**0.0**	**0.3**	**1.5**	**6.7**	**0.4**	**1.8**	**6.8**	**1.4**	**-0.2**
Δ Pr(Pl)	**0.0**	**0.3**	**0.9**	**3.7**	**3.9**	**4.9**	**8.0**	**2.8**	**3.0**
Gap (Bf)	0.1	-0.3	-1.4	-6.6	-0.4	-1.8	-6.7	-1.3	0.2
Gap (Pl)	11.8	11.5	10.9	8.1	7.8	6.9	3.8	9.0	8.8

Panel C: sample of mothers with low SES (45% of women)

	(0) Baseline Predicted	(1) High SES beliefs	(2) Increase returns (v1)	(3) Increase returns (v2)	(4) Playing not costly	(5) 2 + 4	(6) 3 + 4	(7) Treat depression	(8) Educate women
Pr(No-bf, no-pl)	40.1	39.2	38.3	31.6	37.7	36.0	29.6	37.9	36.4
Pr(Bf, no-pl)	34.6	34.9	35.6	39.6	32.6	33.5	36.9	33.6	35.9
Pr(No-bf, pl)	11.8	12.2	12.2	13.4	13.8	14.2	15.5	12.6	15.3
Pr(Bf, pl)	13.5	13.8	13.9	15.3	15.9	16.4	18.0	15.9	12.4
Pr(Bf)	48.1	48.6	49.5	54.9	48.5	49.9	54.9	49.4	48.3
Pr(Pl)	25.3	25.9	26.1	28.8	29.7	30.6	33.5	28.5	27.7
Δ Pr(No-bf, no-pl)	**0.0**	**-0.9**	**-1.8**	**-8.4**	**-2.3**	**-4.1**	**-10.5**	**-2.1**	**-3.6**
Δ Pr(Bf)	**0.0**	**0.5**	**1.4**	**6.8**	**0.4**	**1.7**	**6.8**	**1.3**	**0.1**
Δ Pr(Pl)	**0.0**	**0.6**	**0.8**	**3.5**	**4.4**	**5.3**	**8.2**	**3.2**	**2.4**
Gap (Bf)	1.9	1.4	0.5	-4.9	1.5	0.2	-4.9	0.6	1.7
Gap (Pl)	11.3	10.7	10.5	7.9	7.0	6.1	3.1	8.1	8.9

Note: Predicted probabilities estimated after a multinomial logit model where the preference parameters for children's developmental outcomes are evaluated jointly and where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. Col (0) - Baseline predicted probabilities; Col (1) - Low SES mothers have the beliefs held by the high SES mothers; Col (2) - The probability of children achieving developmental outcomes is increased by 10 pp. Col (3) - The probability of children achieving developmental outcomes is increased by the IQR of the average expected return of single investments (average increase of 43 pp); Col (4) - The effort cost of playing is suppressed; Col (5) - Combines Col (2) and Col (4); Col (6) - Combines Col (3) and Col (4); Col (7) - Depression status is changed to not depressed, and beliefs and costs are set at the value that not depressed mothers have; Col (8) - Education level is set at +10 years of education, and beliefs and costs are set at the value that mothers with +10 years of education have. Low educated mothers are defined as those with 10 or less years of education. The gap in investments is given by the difference between the predicted investment level among the treated group in each of the policy scenarios and the predicted investment level at baseline of the untreated group, which is: Panel A = nondepressed mothers; Panel B = high educated mothers; Panel C = high SES mothers.

Table A17b: Policy evaluations for different subsamples

Panel D: sample of mothers with at least two expected zero return (exluding 0 return on diarrhea from playing) (36% of women)

	(0) Baseline Predicted	(1) High SES beliefs	(2) Increase returns (v1)	(3) Increase returns (v2)	(4) Playing not costly	(5) 2 + 4	(6) 3 + 4	(7) Treat depression	(8) Educate women
Pr(No-bf, no-pl)	42.3	39.4	40.5	33.1	39.4	37.7	30.5	39.3	35.5
Pr(Bf, no-pl)	30.8	32.4	31.7	35.9	28.7	29.4	33.0	30.5	33.3
Pr(No-bf, pl)	12.5	13.1	12.9	14.4	14.8	15.3	16.9	13.5	16.7
Pr(Bf, pl)	14.3	15.1	14.8	16.6	17.1	17.6	19.6	16.7	14.5
Pr(Bf)	45.1	47.5	46.5	52.5	45.7	47.1	52.6	47.2	47.8
Pr(Pl)	26.8	28.2	27.7	31.0	31.9	32.9	36.5	30.2	31.2
Δ Pr(No-bf, no-pl)	**0.0**	**-2.9**	**-1.8**	**-9.2**	**-2.9**	**-4.7**	**-11.8**	**-3.0**	**-6.8**
Δ Pr(Bf)	**0.0**	**2.3**	**1.4**	**7.4**	**0.6**	**1.9**	**7.5**	**2.1**	**2.6**
Δ Pr(Pl)	**0.0**	**1.3**	**0.9**	**4.1**	**5.1**	**6.1**	**9.6**	**3.3**	**4.4**
Gap (Bf)	6.2	3.8	4.8	-1.2	5.6	4.2	-1.3	4.1	3.5
Gap (Pl)	7.1	5.8	6.2	3.0	2.1	1.1	-2.5	3.8	2.8

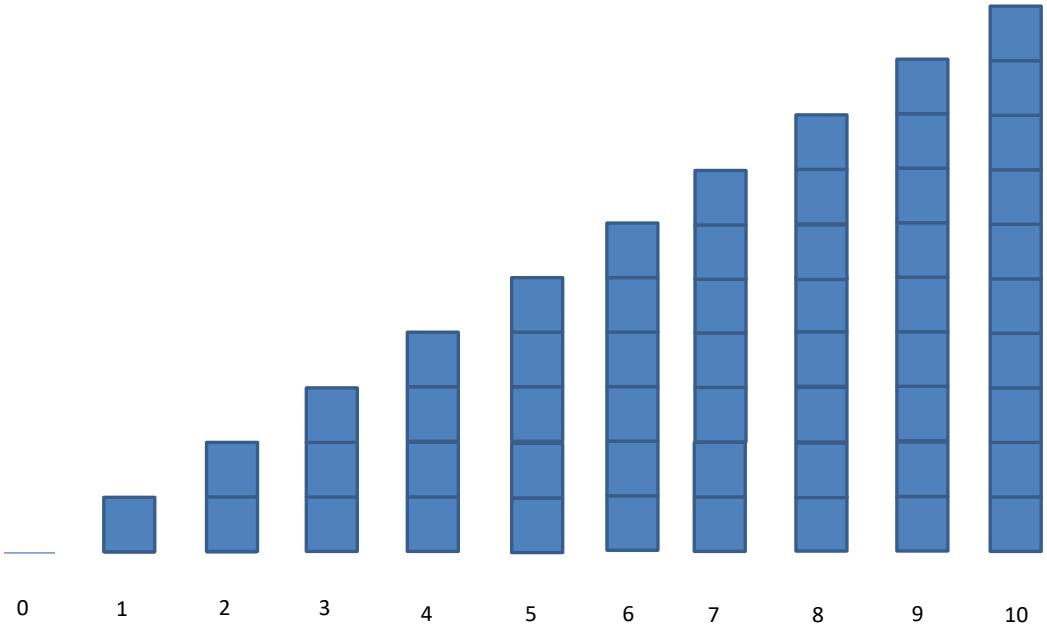
Panel E: sample of mothers with high cost on any investment (17% of women)

	(0) Baseline Predicted	(1) High SES beliefs	(2) Increase returns (v1)	(3) Increase returns (v2)	(4) Playing not costly	(5) 2 + 4	(6) 3 + 4	(7) Treat depression	(8) Educate women
Pr(No-bf, no-pl)	39.9	38.9	38.0	31.1	34.8	32.9	26.6	37.3	35.3
Pr(Bf, no-pl)	36.5	37.0	37.7	41.9	31.8	32.7	35.9	34.1	34.9
Pr(No-bf, pl)	9.8	10.0	10.1	11.1	14.0	14.4	15.6	11.5	15.2
Pr(Bf, pl)	13.8	14.1	14.3	15.8	19.4	19.9	21.8	17.1	14.5
Pr(Bf)	50.3	51.1	51.9	57.7	51.3	52.7	57.8	51.2	49.5
Pr(Pl)	23.6	24.1	24.4	26.9	33.4	34.3	37.4	28.6	29.7
Δ Pr(No-bf, no-pl)	**0.0**	**-1.0**	**-2.0**	**-8.8**	**-5.1**	**-7.0**	**-13.3**	**-2.6**	**-4.6**
Δ Pr(Bf)	**0.0**	**0.8**	**1.6**	**7.4**	**0.9**	**2.4**	**7.4**	**0.9**	**-0.8**
Δ Pr(Pl)	**0.0**	**0.5**	**0.8**	**3.3**	**9.8**	**10.7**	**13.8**	**5.0**	**6.1**
Gap (Bf)	-1.0	-1.8	-2.6	-8.4	-1.9	-3.4	-8.4	-1.9	-0.2
Gap (Pl)	9.5	9.0	8.7	6.2	-0.3	-1.2	-4.3	4.5	3.4

Note: Predicted probabilities estimated after a multinomial logit model where the preference parameters for children's developmental outcomes are evaluated jointly and where mothers' alternatives are: no-bf, no-pl = not breastfeeding and not playing; bf, no-pl = breastfeeding but not playing; no-bf, pl = not breastfeeding but playing; bf, pl = breastfeeding and playing. Col (0) - Baseline predicted probabilities; Col (1) - Low SES mothers have the beliefs held by the high SES mothers; Col (2) - The probability of children achieving developmental outcomes is increased by 10 pp. Col (3) - The probability of children achieving developmental outcomes is increased by the IQR of the average expected return of single investments (average increase of 43 pp); Col (4) - The effort cost of playing is suppressed; Col (5) - Combines Col (2) and Col (4); Col (6) - Combines Col (3) and Col (4); Col (7) - Depression status is changed to not depressed, and beliefs and costs are set at the value that not depressed mothers have; Col (8) - Education level is set at +10 years of education, and beliefs and costs are set at the value that mothers with +10 years of education have. The gap in investments is given by the difference between the predicted investment level among the treated group in each of the policy scenarios and the predicted investment level at baseline of the untreated group, which is: Panel D = mothers with less than two expected zero returns (excluding 0 return on diarrhea from playing); Panel D = mothers with low cost on both investments.

B Data Appendix

Part 1: Questionnaire



Now I am going to ask you some questions about your beliefs regarding certain behaviours that a mother in your community could have and its effect on her child.

Before that, let's talk about how I am going to understand your answers better. We will use different sizes of bars to record your answer. I will show you ten bars of different sizes. I would like you to choose one of the bars out of these ten bars over here to express what you think is the chance of a specific event happening. The smaller the bar, the lesser chances are for that specific event to happen. On the other hand, the bigger the bar the higher the chances are for that specific event to happen. In other words, as you increase the size of the bar the chances increase. If you choose zero, it means you are sure that the event will NOT happen. If you choose 1, it means one chance out of 10. If you choose 1 or 2, it means you think the event is not likely to happen but it is still possible. If you pick 5, it means that it is just as likely it happens as it does not happen (fifty-fifty). If you pick 6, it means the event is slightly more likely

to happen than not to happen. If you put 10, it means you are sure the event will happen. There is no right or wrong answer; I just want to know what you think.

Let me ask you a couple of questions to make sure you understand how to answer using the bars.

Pick the size of the bar that reflects how likely the following event can happen… (*Training questions)*

a) A woman in your community will go to the market at least once within the next 2 days.
b) A woman in your community will go to the market at least once within the next 2 weeks.

Within your community, the maternal behaviors that we are interested in are a) breastfeeding and b) playing with the child. We are interested in whether you think these might influence the health and growth of children (including getting ill, doing well at school, being able to speak and engage with others)

Some people think these behaviors affect their children and some people don't think they make a difference. Among people who think they make a difference, some think they make a big difference and others think they make only a small difference. There is no right or wrong answer, we just want to know what you think. When answering the questions please think of another mother like you.
First, I am going to ask you questions regarding breastfeeding and its influence on the health and growth of children. Please provide your answers to the questions that I will ask you with the help of the bars.

1. In your view, what is the likelihood of a child/infant in your community to frequently have diarrhea:
    a) If the mother exclusively breastfeeds for 6 months.
    b) If the mother does not exclusively breastfeed for 6 months.

2. In your view, what is the likelihood of a child to put 2-3 words together in speaking by age 2 years of his/her life:
    a) If the mother exclusively breastfeeds for 6 months.
    b) If the mother does not exclusively breastfeed for 6 months.

3. In your view, what is the likelihood that a child will happily play with other children by age 3:
    a) If the mother exclusively breastfeeds for 6 months.
    b) If the mother does not exclusively breastfeed for 6 months.

4. In your view, what is the likelihood that a child in your community will learn well at school:
    a) If the mother exclusively breastfeeds for 6 months.
    b) If the mother does not exclusively breastfeed for 6 months.

Now we are going to ask the same questions that we asked earlier but this time we will relate them to someone who plays with the child instead of to breastfeeding behavior. Again, there is no right or wrong answer; we just want to know what you think.

Please provide your answers to the questions that I will ask you with the help of the bars.

1. In your view, what is the likelihood of a child/infant in your community to frequently have diarrhea:
    a) If the mother plays with the child frequently to help them learn new things
    b) If the mother plays with the child rarely to help them learn new things

2. In your view, what is the likelihood of a child to put 2-3 words together in speaking by age 2 years of his/her life:
    a) If the mother plays with the child frequently to help them learn new things
    b) If the mother plays with the child rarely to help them learn new things

3. In your view, what is the likelihood that a child will happily play with other children by age
    a) If the mother plays with the child frequently to help them learn new things
    b) If the mother plays with the child rarely to help them learn new things

4. In your view, what is the likelihood that a child in your community will learn well at school:
    a) If the mother plays with the child frequently to help them learn new things
    b) If the mother plays with the child rarely to help them learn new things

Part 2: Construction of variables

Measuring depression

Depression was assessed using the patient health questionnaire (PHQ-9), which queries a series of symptoms of depression, each being scored on a four-point Likert scale. The PHQ-9 asks about the following 9 items: 1) Little interest or pleasure in doing things. 2) Feeling down, depressed, or hopeless. 3) Trouble falling or staying asleep, or sleeping too much. 4) Feeling tired or having little energy. 5) Poor appetite or overeating. 6) Feeling bad about yourself — or that you are a failure or have let yourself or your family down. 7) Trouble concentrating on things, such as reading the newspaper or watching television. 8) Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual. 9) Thoughts that you would be better off dead or of hurting yourself in some way. Women were classified as depressed when their score was 10 or above, as this cut-off point has been proven to have a high predictive power for the diagnosis of depressive disorder (Kroenke, Spitzer, and Williams 2001).

Measuring maternal investments

Exclusive breastfeeding is measured by asking mothersall the nutrients given to their child in the last 24 hours, including breast milk, a herbal cocktail (*ghutti)*, herbal water, water, tea (*chai*), formula milk, other animal milk (cow, goat, buffalo), semi-solid food, solid food, or other. See **Appendix Table A7** for a detailed summary of feeding practices in our study area. Mothers are considered as exclusively breastfeeding if they are giving only breast milk.

Play is measured through a question collected within the Infant-Toddler HOME (Home Observation Measurement of the Environment) inventory questionnaire designed for children aged 0-3 (Cox and Walker 2002). The enumerators are instructed to look out for the behavior and to question the mother. The HOME inventory has 6 sections covering the following topics:

I. RESPONSIVITY

1. Parent permits child to engage in "messy" play.
2. Parent spontaneously vocalizes to the child at least twice.
3. Parent responds verbally to the child's vocalizations or verbalizations.
4. Parent tells child name of object or person during visit.
5. Parent's speech is distinct, clear, and audible.
6. Parent initiates verbal interchanges with visitor.
7. Parent converses freely and easily.
8. Parent spontaneously praises child at least twice.

9. Parent's voice conveys positive feelings towards child.
10. Parent caresses or kisses child at least once.
11. Parent responds positively to praise of child offered by visitor.

II. ACCEPTANCE

12. No more than one instance of physical punishment during past week.
13. Family has a pet.
14. Parent does not shout at child.
15. Parent does not express overt annoyance with or hostility to child.
16. Parent neither slaps nor spanks child during visit.
17. Parent does not scold or criticize child during visit.
18. Parent does not interfere with or restrict child more than three times during visit.
19. At least ten books are present and visible.

III. ORGANIZATION

20. Child care, if used, is provided by one of three regular substitutes.
21. Child is taken to grocery store at least once a week.
22. Child gets out of house at least four times a week.
23. Child is taken regularly to doctor's office or clinic.
24. Child has a special place for toys and treasures.
25. Child's play environment is safe.

IV. LEARNING MATERIAL

26. Muscle activity toys or equipment.
27. Push or pull toys.
28. Stroller or walker, kiddie car, scooter, or tricycle.
29. Cuddly toys or role- playing toys.
30. Learning facilitators-mobile, table, and chair, high chair, play pen.
31. Simple hand-eye coordination toys.
32. Complex hand-eye coordination toys.
33. Toys for literature and music.
34. Parent provides toys for child to play with during visit.

V. INVOLVEMENT

35. Parent talks to child while doing household work.
36. Parent consciously encourages developmental advance.
37. Parent invests maturing toys with value via personal attention.
38. Parent guides during play/structures child's play period
39. Parent provides toys that challenge child to develop new skills.
40. Parent keeps child in visual range, looks at often.

VI. VARIETY

41. Father provides some care daily.
42. Parent reads stories to child at least three times weekly.
43. Child eats at least one meal a day with mother and father.
44. Family visit relatives or receives visits once a month or so.
45. Child has three or more books of his/her own.

All items are answered with either yes (value of 1) or no (value of 0). Our main outcome of *play* uses the answer to item 38. In section 6, we conduct robustness checks by considering mothers to be making the playing investment when she scores in the top tertile of:

1- The HOME Score
2- The Stimulation Score (combining the score in the Responsivity and Involvement sections)
3- The first principal component (PCA) of the Stimulation items (Responsivity and Involvement items)

Measuring expected cost

We elicited expected effort costs associated with making the investments by asking mothers at baseline (before birth) to report on a Likert scale how tiring they expected it would be to breastfeed or to play with a baby. The scale had 4 points, indicating rarely or never, sometimes, most of the times, or don't know.

Other constructed variables

Wealth: We construct a measure of wealth using an asset-based index that has been widely in household surveys such as the Demographic and Health Surveys. It is constructed using polychoric correlations, more suited for categorical variables than standard correlations (Kolenikov, 2004). It includes asset variables for which less than or equal to 90% of people owned the asset and less than or equal to 90% of people did not own the item. This ensured enough variability in the items going into the principal components score. The full list of assets meeting this condition was: own or rent a farm, ownership of animals, radio, television, fridge, washing machine, electric water pump, bed, chair, cabinet, clock, sofa, sewing machine, camera, laptop computer, wrist-watch, car/truck, piped natural gas, flush toilet, roof made of reinforced brick cement or concrete cement, wall made of baked bricks or cement blocks, and floor made of bricks/terrazzo or ceramic tiles.

Farming household: If women respond that she or any other household member owns or rent any land for farming, we consider the women as living in agricultural or farming household (60% of households).