Institute for Fiscal Studies

Gabriella Conti
Michele Giannola
Alessandro Toppeta

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Parental Beliefs, Perceived Health Risks, and Time Investment in Children

Gabriella Conti Michele Giannola Alessandro Toppeta*

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Abstract

When deciding how to allocate their time between different types of investment in their children, parents weigh up the perceived benefits and costs of different activities. During the COVID-19 outbreak parents had to consider a new cost dimension when making this decision: the perceived *risks* associated with contracting the virus. What role did beliefs about risks and returns play for the allocation of time investment in children during the pandemic? We answer this question by collecting rich data on a sample of first-time parents in England during the first lockdown, including elicitation of perceived risks and returns to different activities via hypothetical scenarios. We find that parents perceive their own time investment to be more productive and less risky than the time spent by their children in formal childcare or with peers. Using detailed time use data on children's daily activities, we show that heterogeneity in beliefs contributes to explain heterogeneity in investment choices across parents. We also document that less educated parents perceive both lower developmental returns and lower health risks from investments, while we find limited evidence of heterogeneity in preferences by socioeconomic status. This indicates that beliefs – rather than preferences – heterogeneity could contribute to inequalities in early years development, and suggests the need for timely and targeted provision of information on the actual returns and risks to different investments.

Keywords: parental beliefs, health risks, time investments, childcare, text data, coronavirus.

JEL: I12, I26, J13.

*G. Conti: University College London, the Institute for Fiscal Studies, CEPR, CESifo and IZA. Email: gabriella.conti@ucl.ac.uk, M. Giannola: University of Naples Federico II, CSEF and the Institute for Fiscal Studies. Email: michele.giannola@unina.it. A. Toppeta: SOFI, Stockholm University. Email: alessandro.toppeta@sofi.su.se. Gabriella Conti has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 819752 DEVORHBIOSHIP - ERC-2018COG). This project has received ethics approval by the UCL IOE Research Ethics Committee (REC 1391). We thank seminar participants to SEHO (2022), Family/Labor Workshop (KU Leuven), BSE Summer Forum Workshop on Children's Health, Well-being, and Human Capital Formation, and to the EcHO workshop (RHUL) for useful comments. We thank Ella Johnson-Watts and Mirjam Otten for outstanding research assistance.

1 Introduction

Early years investments are crucial for children's health, cognitive and socio-emotional development, which are in turn important predictors of lifecourse well-being and socio-economic outcomes (see Currie and Almond (2011) and Almond, Currie, and Duque (2018) for reviews). Since parents are the primary providers of care and stimulation in the early years, the role that their investments play in the process of human capital formation is fundamental. Recent studies have shown that parental beliefs about the technology of skill formation, including about the *returns* to different inputs, influence the type and level of investments that parents make in their children (Cunha, Elo, and Culhane (2013); Boneva and Rauh (2018); Attanasio, Cunha, and Jervis (2019); Bhalotra, Delavande, Gilabert, and Maselko (2022)), and the allocation of investments across siblings (Giannola (2024)).

The COVID-19 outbreak has led to school closures worldwide (UNESCO, 2020), with significant learning and developmental losses for children (Engzell, Frey, and Verhagen (2021); Maldonado and De Witte (2021)). With schools being closed, the choices parents have made about the specific ways to invest in their children's human capital have become even more salient. Indeed, differences in parental inputs during lockdown have been associated with differences in children's outcomes (Davies et al. (2021)). Although it is now accepted that COVID-19 infection in children appears to be less widespread and severe than in adults (Boast, Munro, Goldstein, et al. (2020), Lavezzo et al. (2020); Park et al. (2020), Oster and Alter (2021); Thompson and Rasmussen (2021); Christophers et al. (2022)), the potential transmission of the virus between children and adults, and the role played by schools in this process remained uncertain for most of 2020. Therefore, besides the monetary costs of different investments, parents had also to consider a new dimension: the *risks* associated with the various activities, i.e., the chances of contracting COVID-19, with the associated consequences that this might entail. In this context, parents may be less likely to send their child to formal childcare if they perceive a greater COVID-19 infection risk from childcare relative to other activities, or if they believe they can substitute formal childcare with other investments, such as parental play. These expectations might also be heterogeneous across people with different characteristics, potentially leading to different investment responses to the COVID-19 outbreak.

In England (the context of this study) and elsewhere, the provision of home learning during lockdown has not been equal across families, with children in better-off households enjoying more home learning activities, and being twice as likely to return to school after its reopening (Andrew et al. (2020); Cattan et al. (2021); Kate et al. (2021); Oppermann et al. (2021)). These inequalities in inputs are concerning, since they might lead to further widening of pre-existing inequalities in child development - especially for small children, for whom school attendance is not compulsory until age five. In England, the COVID-19 pandemic has impacted the Early Childhood Education and Care (ECEC) sector in a number of ways, including temporary and permanent closures of ECEC settings, reduced demand for ECEC places and workforce challenges (La Valle et al. (2022)). However, while parental investment choices during the pandemic have been documented (and their longer-term consequences are being investigated), the

underlying perceptions of the benefits and costs associated with them, and how these perceptions relate to investment decisions, have not been examined to date.

This paper presents the first evidence on the beliefs parents had about risks and returns to different types of investment during the COVID-19 pandemic, and sheds light on their implications for actual parental investment behavior. We collected new survey data from a sample of 560 first-time parents in England, during the course of the first COVID-19 wave. We interviewed parents in July 2020, just after the ease of the lockdown restrictions, and recorded detailed information on childcare arrangements used before, during and after the lockdown. We further collected time use diaries to study how parental investment decisions varied during and after the lockdown.

To gain a better understanding of parents' decision making processes regarding children human capital investments, we collected information on parental beliefs, building on the seminal work by Cunha, Elo, and Culhane (2013, 2022). We used hypothetical scenarios which vary in terms of the level of different types of investments.[1] While previous research on parental beliefs has focused exclusively on the role of perceived returns, we expand this approach to elicit direct information about the perceived (COVID-19-related) *risks* associated with different types of investments. We focus on three specific types of investments which could have been made by parents during lockdown, and which might entail a substantially different trade-off between risks and returns: formal childcare, parental play, and child play with friends. To gain a more comprehensive characterization of these beliefs and understand parents' first-order concerns when thinking about their children's development and the risks associated with catching COVID-19, we also asked open-ended questions to the respondents. We analyse these data using natural language processing (NLP) techniques, and use the results from the textual analysis to better interpret parental beliefs about risks and returns in the context of the COVID-19 pandemic.

This rich and novel data allows us to improve our understanding of parental decision-making in a situation of high health risk and uncertainty. Our analysis provides three main results. First, using the time use survey we document a significant decline in the use of formal childcare since the start of the first lockdown in England, and confirm the official figures that this decrease was large even among children of key workers and vulnerable children, who were eligible for, and allowed to attend, formal childcare throughout the pandemic. We also show that, despite nurseries and playgroups reopened to all children on the first of June 2020 and offered holiday care over the summer break (Department for Education (2020a)), the use of these services did not increase to pre-lockdown levels by the end of summer 2020.

Second, we study parental beliefs and document several novel facts. While parents believe that childcare, parental play, and child play with friends all improve child development, each activity is also perceived to increase the risk of contracting COVID-19. On average, among these different types of

[1] In the context of parental human capital investment decisions, other studies have used this approach to study expected returns to health investments (Biroli, Boneva, Raja, and Rauh (2022)), the perceived relative productivity of early and later investments (Boneva and Rauh (2018)), the perceived returns to and effort costs of breastfeeding and stimulation for newborns (Bhalotra, Delavande, Gilabert, and Maselko (2022)), and parental allocation of resources between siblings (Giannola (2024)). In the context of COVID-19, Conti and Giustinelli (2022) use hypothetical scenarios to elicit subjective expectations about costs and benefits of compliance to COVID-19 social distancing regulations in the UK, while Chen, Cortes, Kosar, Pan, and Zafar (2023) elicit workers' expectations and preference for remote work in the US.

investments, parental play is perceived to improve child development the most, and to increase the likelihood of catching COVID-19 the least. We also show that parental play is perceived by the respondents to be a *substitute* for formal childcare. The NLP analysis of open-ended questions suggests that, although for many parents the lack of socialization was a key concern in relation to their child development, they indeed felt they could handle childcare themselves. This might explain why, in our data, we observe that parents substituted formal childcare with their own time even after the ease of the lockdown restrictions, when childcare centers reopened for all children.

Third, we document substantial heterogeneity in parental beliefs, and investigate whether perceived returns and risks vary systematically with socio-economic status (SES). On the one hand, similarly to Boneva and Rauh (2018) and List, Pernaudet, and Suskind (2021), we find that less educated parents, on average, perceive returns to investments to be 23%-34% lower than more educated parents. On the other hand, we provide evidence that less educated parents, on average, also systematically perceive lower health risks from investments. Moreover, our analysis of the open-ended questions indicates that parents who express heightened concerns about the impact of the COVID-19 outbreak on their lives tend to perceive lower returns to their investments in their child. This result is interesting in light of the recent evidence showing that parental mental well-being is key to explaining investments decisions in children (Baranov, Bhalotra, Biroli, and Maselko (2020)), and is consistent with research in clinical psychology showing that, by distorting beliefs, mental health can affect the way people think and behave (Gotlib and Joormann, 2010).

We then show that expected returns and risks correlate with actual choices. While we do not interpret these correlations as a causal effect of beliefs on choices, we show that parents who perceive a greater return from childcare are more likely to send their child to childcare in the summer of 2020. Conversely, a larger perceived health risk from childcare attendance has a significant negative association with childcare use. At the same time, a higher expected benefit from parental play is significantly positively associated with the time spent by the parents (both the mother and the father) playing with the child. Moreover, a higher perceived return (risk) to play with friends is associated with an increase (decrease) in playground use in July 2020. We show that these results hold both for higher and lower-SES parents, suggesting that perceived returns and risk are important drivers of behaviour even for families who might be more financially constrained in their ability to invest in children.

Finally, combining beliefs data with investment choices, we estimate a discrete choice model in which parents decide which level of formal childcare, parental play and play with friends to select for their child. Our results confirm that heterogeneity in beliefs across respondents contribute to differences in investments. Our estimates further suggest that parents place a positive utility weight on their children's human capital outcome and a negative utility weight on catching COVID-19. We also find limited evidence of heterogeneity in preferences across higher- and lower-SES parents, suggesting a limited role for it in explaining variation in investments.

This study contributes to the literature in three ways. First, we contribute to the small but growing

literature studying the role of parents' subjective beliefs in determining investments in their children (Cunha, Elo, and Culhane (2013); Boneva and Rauh (2018); Attanasio, Cunha, and Jervis (2019); Attanasio, Boneva, and Rauh (2020); Dizon-Ross (2019); List, Pernaudet, and Suskind (2021); Giannola (2024)). This literature has, for the most part, focused on the role of perceived *returns* to investments. One exception is Bhalotra, Delavande, Gilabert, and Maselko (2022) who consider the role of expected returns *and* effort costs to breastfeeding and play to understand maternal investment in children. We advance this literature by showing that, at a time of high uncertainty and risk due to the COVID-19 pandemic, the perceived *risks* of catching and transmitting COVID-19 associated with different types of investments are equally relevant to understand parents' behaviour. In this respect, this paper connects to the literature investigating the role of perceived risks to understand sexual behaviour, demand for contraception, and risky health investments, such as smoking and drinking (Delavande (2008); Dupas (2011); Delavande and Kohler (2012); Godlonton and Thornton (2013); De Paula, Shapira, and Todd (2014); Godlonton, Munthali, and Thornton (2016); Gong (2015); Delavande and Kohler (2016); Miller, De Paula, and Valente (2020); Arni, Dragone, Goette, and Ziebarth (2021); Derksen, Muula, and van Oosterhout (2022)).

Second, this study relates to the recent literature investigating childcare arrangements and (home) schooling during the COVID-19 pandemic (Andrew et al., 2020; Bol, 2020; Sevilla and Smith, 2020; Cattan et al., 2021; Musaddiq et al., 2022; Agostinelli et al., 2022), and in particular the heterogeneous responses of parents by socio-economic status. One common explanation that has been proposed to rationalise them is the differential availability of educational options (in-person or virtually) across socio-economic groups (Camp and Zamarro (2022)). Our results suggest the existence of a complementary explanation: the heterogeneity in perceived risks and returns about different types of investments - including formal childcare attendance - across socio-economic groups. This heterogeneity implies that parents could have selected different types of investments even when provided with the exact same educational opportunities. The fact that we find a similar relation between beliefs and choices across higher- and lower-SES respondents, and that the preference parameters estimated from the discrete choice model are homogeneous across respondents, suggests that beliefs might play a role in explaining observed behavior over and above existing financial constraints. These results also contribute to our understanding of the differential impacts of the pandemic on children's developmental outcomes by socioeconomic status – for which evidence is growing (Engzell, Frey, and Verhagen (2021); Hobbs and Bernard (2021); Maldonado and De Witte (2021)) – and suggest important avenues for targeted informational interventions.

Third, from a methodological standpoint, we apply natural language processing techniques to analyse textual data in order to contextualize the information of parental beliefs that we collect in relation to the COVID-19 pandemic. Similar techniques have been recently used to understand, for example, peoples' attitudes towards taxation (Ferrario and Stantcheva (2022)) or women's agency (Jayachandran, Biradavolu, and Cooper (2023)). While we apply this technique to understand parental first-order concerns in relation to the COVID-19 outbreak and children's development, our results suggest that this type of

analysis can be more broadly applied to open up the black box of parental decision-making, and better understand and characterize information on individual subjective expectations. As argued by Ferrario and Stantcheva (2022), we suggest that this type of data can be a useful complement for more traditional closed-ended questions.

The remainder of this paper is structured as follows. Section 2 presents a simple theoretical framework that motivates and guides our empirical analysis. Section 3 describes the data collection, the sample, the survey instruments, and the empirical methods used. Section 4 presents descriptive results on childcare, time use during and after the lockdown. We present the results on parental beliefs in Section 5, and in Section 6 we study whether these beliefs are predictive of actual investment decisions. Section 7 concludes.

2 Theoretical framework

In this Section, we present a stylized model to highlight the basic trade-off a parent faces when deciding how to invest in her child's human capital in presence of health risks from that investment – with an application to the COVID-19 pandemic. In our framework, the parent's investment choices have two distinct effects: on the one hand, they might enhance child development; on the other hand, they might entail a risk in terms of likelihood of COVID-19 infection. We use this simple theoretical framework to guide the design of the novel data we collected on perceived returns and risks of investment and to motivate our empirical analysis of how perceived returns and risks shape parental investment decisions during the pandemic.

We assume a unitary model of the household. As in standard models of investment in human capital, we further assume that the parent cares about her own consumption C_i and about the human capital of her child K_i (see for example Attanasio (2015)). We augment this model by assuming that the parent incurs a utility cost if her child catches or transmits COVID-19. We do not seek to explain where this utility cost comes from, and recognize that different explanations could justify the dependence of the utility function on COVID-19 infection, such as social stigma associated with contracting the virus (Bagcchi (2020)), an increased mortality risk (Yanez et al. (2020)), or a direct monetary cost related to increased health expenses (Baker et al. (2020)).[2]

We assume that the parent can select for her child three different types of investments to promote her development. The first two investments are the level of parental play, I_{Pi}, and the level of play with friends I_{Fi} (given the young age of the children we study, we assume this play activity to be supervised by the parent, and to happen outside formal childcare, e.g. in the playground). Moreover, the parent decides whether to send her child to formal childcare (such as nursery or preschool) I_{Si}, which is also assumed to promote child development. In addition to promoting child human capital, these various types of investments I_{Si}, I_{Pi}, I_{Fi} may also affect the likelihood of the child catching and transmitting

[2] In Section 5, we use textual data to gain a deeper understanding about what dimensions parents were considering when thinking about the risks of catching the virus.

COVID-19.[3]

Following the modelling framework in Bhalotra, Delavande, Gilabert, and Maselko (2022), we assume that the parental utility function is additively separable and logarithmic in consumption, and we express it as:

$$U_i(c_i, K_i, COVID_i, \epsilon_{Ii}) = \alpha ln(c_i) + u(K_i) + v(COVID_i) + \epsilon_{Ii} \tag{1}$$

where α is the utility value of consumption, $u(K_i)$ is the utility the parent derives from her child human capital, $v(COVID_i)$ is the disutility she derives from her child catching or transmitting COVID-19, and ϵ_{Ii} is a random term which is individual- and investment-specific, and known to parent i at the time investments are made (but not known to the econometrician).

Instead of assuming that the parent knows the process of human capital formation, we follow Cunha, Elo, and Culhane (2013, 2022), and assume that the parent has some subjective beliefs about how investments map into her child's future outcomes. We denote this subjective probability as $\Psi_i(K_i|I_{Si}, I_{Pi}, I_{Fi})$. Similarly, we assume that the parent has some subjective beliefs about how different investment will affect the likelihood of catching and transmitting COVID-19 and denote this subjective probability as $\Omega_i(COVID_i|I_{Si}, I_{Pi}, I_{Fi})$. Under these assumptions, the subjective utility of the parent associated with selecting investment profile I_{Si}, I_{Pi}, I_{Fi} is given by:

$$EU_i = \alpha ln(c_i) + \Psi_i(K_i|I_{Si}, I_{Pi}, I_{Fi})u(K_i) + \Omega_i(COVID_i|I_{Si}, I_{Pi}, I_{Fi})v(COVID_i) + \epsilon_{Ii}$$

Therefore the problem of the parent can be expressed as:

$$\max_{I_{Si}, I_{Pi}, I_{Fi}} \quad \alpha ln(c_i) + \Psi_i(K_i|I_{Si}, I_{Pi}, I_{Fi})u(K_i) + \Omega_i(COVID_i|I_{Si}, I_{Pi}, I_{Fi})v(COVID_i) + \epsilon_{Ii}$$

This simple model highlights the basic trade-off that the parent faces when deciding how to invest in her child during the COVID-19 pandemic: on the one hand, she might want to select the types and levels of investments which she perceives to be the most productive. On the other hand, she might want to avoid investments that are perceived too risky for her own health, in terms of the likelihood of catching COVID-19.

We acknowledge that the model is relatively simple as we do not explicitly model the parents' budget or time constraint. Following Delavande, Del Bono, and Holford (2022) and Bhalotra, Delavande, Gilabert, and Maselko (2022), in our empirical specification we will produce separate estimates for higher and lower-SES parents to understand the way in which constraints and beliefs interact to explain observed investment patterns.

[3] In our framework, we abstract from monetary investments that help children develop (such as buying toys or books) for simplicity and because there is no health risk associated with them. For example, a parent willing to read to her child could always download an e-book from an online repository. The model could be easily extended to accommodate them, but in our survey we did not collect information on parental beliefs about these investments or on their actual use by the respondents.

3 Data and Empirical Strategy

3.1 Participants and Sample Characteristics

We recruited survey participants through Prolific Academic, an online platform for web-based research, and administered our survey in July 2020, after the ease of the lockdown restrictions and the re-opening of early years setting to all children (June 1, 2020).[4] Our sample consists of 560 first-time parents living in England, with a child younger than five years of age, who had not started primary school or reception pre-lockdown. We focused exclusively on England since the lockdown restrictions differed across the United Kingdom, and zoomed in on first-time parents because we expected them to be less experienced and so in the greatest need of parenting support (and as such more likely to have suffered from pandemic-related formal childcare closures, health visitors redeployment (Conti and Dow (2020)), or unavailability of grandparents). In each household, we surveyed only one parent, who was the biological mother of the child in 78% of the cases (the remaining respondents were the biological father (21%), or the legal mother or father of the child (0.72%)).

Table 1 reports descriptive statistics for our sample. Almost 80% of respondents were female, 11% were non-white, and their average age was 31. The average age of the child was 1.4 years at the baseline, and 51% of children were boys. 30% of respondents in our sample were key workers, that is, employed in health and social care and in other key sectors (such as those essential to the running of the justice system, or workers employed in charities and delivering key frontline services);[5] Children of key workers and vulnerable children were eligible to attend formal childcare throughout the lockdown period (Department for Education (2020b)). In terms of socio-economic characteristics, 85% of respondents lived with their partner; 7% of respondents reported a level of education equivalent to the General Certificate of Secondary Education (GCSE) or lower, 26% had completed further education, and the rest had some tertiary education.[6] 78% of our sample is employed at the time of the survey (among these 52% works from home), 8% is furloughed and 5% unemployed.

To gauge the representativeness of our sample, we extract data on parents with a single child from the Millennium Cohort Study (MCS), a nationally representative cohort study in the UK, which follows a cohort of children born in 2000. In the MCS, 82% of the respondents report living with their partner, and 54% of the mothers report having continued their education after compulsory schooling; the corresponding figures for our sample are, respectively, 85% and 67%, hence the mothers in our sample seem to be slightly more educated than those in the MCS (to be expected in part given that at least two decades have passed

[4] Prolific Academic is considered to be reliable, and of superior quality compared to alternative platforms such as Amazon Mechanical Turk (MTurk) (Peer, Brandimarte, Samat, and Acquisti (2017)). Quality control is strict and thorough, and respondents are fairly compensated for their time.

[5] This is slightly higher than the 22% figure reported in Farquharson, Rasul, and Sibieta (2020), which refers to all UK working-age individuals.

[6] The General Certificate of Secondary Education (GCSE) is equivalent to High School Diploma in the United States. A student typically studies for GCSE between the ages of 11-16 and this qualification grants access to further education. The GCSE is the main school-leaving certificate in England, Wales, and Northern Ireland. Once a student completes the GCSE certificate, they have the option to extend into further education to take their A-Levels, or other similar qualification. UK students planning to go to college or university must complete further education. A-Levels are qualifications within the further education section and are taken between the ages of 16-18. Gaining these allows access to a university.

Table 1: Descriptive statistics

	Mean	S.D.	N
Panel A: Child characteristics			
Child is a boy	0.513	0.500	557
Child age in years	1.356	1.000	559
Panel B: Respondent characteristics			
Age	31.439	5.082	551
Female	0.785	0.411	559
White	0.886	0.319	559
Key worker	0.301	0.459	559
Lives with partner	0.852	0.356	559
Education:			
- GCSE or lower	0.073	0.260	549
- Further education	0.260	0.439	549
- Higher education	0.448	0.498	549
- Postgraduate	0.219	0.414	549
Employment :			
- Employed	0.782	0.413	559
- Unemployed	0.052	0.222	559
- Furlough	0.079	0.270	559
- Out of labor force	0.088	0.283	559

Notes: Some variables are missing as respondents were allowed to choose not to answer some questions. GCSE stands for General Certificate of Secondary Education. Further education corresponds to A-Levels, or other similar qualification. Higher education corresponds to an undergraduate university degree. Postgraduate corresponds to e.g., a Master Degree or higher. S.D. = Standard Deviation. N = sample size.

between the two surveys).

3.2 Time use diaries

Besides their background characteristics, we asked respondents to report the childcare arrangements they used before, during and after the lockdown: both formal ones (such as nursery, preschool or creche), and informal ones (such as nannies, friends, grandparents and other relatives).

We also asked parents to complete a detailed time use diary for their child, which is a unique feature of our survey, since time use data for children under five are rarely collected.[7] At the time of our survey, in July 2020, respondents were asked to choose a weekday in April 2020 (during the first lockdown in England), and a weekday in the first week of July 2020, after the easing of the social distancing restrictions and the reopening of early years settings to all children.[8] For each of these two days, respondents were presented on the screen with a time use diary composed of 1-hour slots between 6:00 am and 11:00 pm, amounting to 17 1-hour slots. For each of these 1-hour periods, respondents were asked to report the activities the child was doing ("*What was your child doing at this time?*") and who was involved in the activity with the child ("*Who was actively involved in what the child was doing?*"). Parents could select

[7] Two exceptions are the Child Development Supplement of the Panel Study of Income Dynamics (CDS-PSID, see e.g., Del Boca, Flinn, and Wiswall (2014)) and the Longitudinal Study of Australian Children (LSAC, see e.g., Fiorini and Keane (2014)). See also Bigoni et al. (2023) for a new time-use diary app for under fives.

[8] We believe recall bias is not a major concern in this case: on the one hand, under strict lockdown, all weekdays in April 2020 were likely to be very similar to each other; on the other hand, the first week of July 2020 was particularly salient, as marking the easing of the restrictions after a long and hard lockdown.

activities among a pre-specified set of options (e.g., for the activities: playing, personal care, sleeping), and each activity could be chosen if it had occurred at any point during the 1-hour slot - i.e., the child did not have to be doing that activity for the entire hour. Respondents were allowed to choose multiple options at the same time (e.g., between 7:00 and 8:00 the child may have been doing personal care and eating).

3.3 Beliefs

3.3.1 Measurement

We collected respondent's perceived returns and health risks associated with different type of parental investments in child human capital. To do so, we followed Cunha, Elo, and Culhane (2013, 2022), and presented respondents with a series of hypothetical investment scenarios, asking them to state what they believed the outcome would be. By varying the characteristics of the scenarios one at a time, while keeping other factors constant, one can identify the perceived returns and risks associated with different types of investments. Our scenarios vary according to three investments with two levels of intensity each: (i) formal childcare attendance (attending vs. not attending), (ii) parental play with child (frequent vs. rare), and (iii) child play with friends (frequent vs. rare). We describe in more details the scenarios later in this section.

To elicit subjective expectations about probabilities (e.g., the chances of catching and transmitting COVID-19), we employed a frequentist approach, and asked parents to think about "100 children the same age as yours" when reporting their answers (see Delavande (2014) for a systematic review on different methods to elicit expectations). Using frequencies rather than probabilities (e.g., "what percentage of children") has the advantage of being easier to understand and to visualise (Hoffrage, Lindsey, Hertwig, and Gigerenzer (2000); Biroli, Boneva, Raja, and Rauh (2022); Bhalotra, Delavande, Gilabert, and Maselko (2022)).

Hypothetical scenarios. Each respondent was presented with eight hypothetical scenarios. To collect information on the perceived returns associated with different types of investments, we asked parents to *"Imagine 100 children of the same age as yours, living in England"*, and to report how many out of these children were expected to *"Reach a Good Level of Development (GLD) by September 2020"*. The Good Level of Development (GLD) indicator is a performance measure used at the end of reception by the Department for Education to determine school readiness of preschool-aged children. This indicator falls within the Early Years Foundation Stage (EYFS) statutory framework, which sets the standards that school and childcare providers must meet for the learning, development and care of children from birth up to age five (Department for Education (2021, 2022)). According to the EYFS profile 2022 handbook: "Children are defined as having reached a Good Level of Development (GLD) at the end of the EYFS if they have achieved at least the expected level for the Early Learning Goals (ELGs) in the prime areas of

Table 2: Overview of outcomes and scenarios

	Formal childcare: I_S		Parental play: I_P		Play with friends: I_F	
Returns: Reaching a Good Level of Development by September 2020	Yes: A	No: N	Frequent: F	Rare: R	Frequent: F	Rare: R
Risks: Contracting and transmitting COVID-19 by September 2020	Yes: A	No: N	Frequent: F	Rare: R	Frequent: F	Rare: R

Notes: The Table summarizes for each outcome (realized by September 2020) the different intensity level of investments. These questions were asked in July 2020. "Parental play" refers to parents play with the child; "Formal childcare" refers to attendance at a formal childcare setting (e.g. nursery or preschool); "Play with friends" refers to child playing with her friends (e.g. at the playground).

learning and the specific areas of mathematics and literacy." and "The EYFS profile is also used to inform parents about their child's development." (Department for Education (2022) p.6). The term GLD is also often mentioned in the popular press and in the media.[9] Hence, we assume that parents are reasonably familiar with the GLD concept when answering the hypothetical scenarios questions. Similarly, to collect information on the perceived risks associated with different types of investments, we asked parents to report how many out of the "100 children the same age as your child" they expected *"Would contract and transmit COVID-19 by September 2020"* if they engaged in the level of investment described in each scenario.

For each of these two outcomes (child development or COVID-19 infection), we varied the intensity level of each type of investment across the 8 scenarios and asked respondents to report their answer. For example, the first scenario (with high levels of the three investments) read as *[...if] "They currently attend nursery or other early years provider, their parent/s spends time reading and playing with them frequently and they have playdates with friends frequently".* For simplicity, we refer to the time spent with parents simply as "parental play". We summarize the eight different scenarios in Table 2: as shown, they vary in terms of (i) formal childcare attendance I_S, (ii) intensity level of parental play I_P, and (iii) intensity level of play with friends I_F.

To elicit respondents' beliefs, we used a clickable slider ranging from 0 to 100 with the multiples of 10 labelled. This technique has been found to minimize response anchoring and to have desirable properties with respect to rounding and "focal" responses such as 0, 50, 100 (Bruine de Bruin and Carman (2018); Giustinelli, Manski, and Molinari (2022)).

3.3.2 Perceived returns and risks

Comparing respondents' subjective probabilities reported in each scenario, we can identify the perceived returns and risks to different types of investments. For example, by comparing the expected numbers of children catching COVID-19 when attending or not formal childcare, holding fixed the level of *all* other investments, we can identify the perceived risks associated with formal childcare attendance, conditional on the level of parental play and play with friends.

[9] See for example https://www.theguardian.com/education/2022/aug/16/no-improvement-in-school-attainment-gap-in-england-for-20-years-report-says and https://www.theguardian.com/politics/2023/jul/07/missions-v-priorities-how-starmer-policy-goals-compare-with-sunak-labour.

More formally, to estimate *average* perceived returns and risk we use the following specification, which we estimate via Ordinary Least Squares (OLS):

$$y_{ij}^k = \delta_0^k + \delta_1^k I_{Pj} + \delta_2^k I_{Sj} + \delta_3^k I_{Fj} + \gamma_i + u_{ij}^k \tag{2}$$

where y_{ij}^k is the answer of parent i, in scenario j to the question eliciting beliefs about outcome type k (child development or COVID-19 infection). The variables I_{Pj}, I_{Sj}, and I_{Fj} are dummy variables for each of the three types of investments (parental play, formal childcare attendance, play with friends), and take value 1 if in scenario j the level of investment is high, and 0 otherwise, and u_{ij}^k is an error term. The coefficients δ_1^k, δ_2^k, and δ_3^k are informative of *average* perceived returns or risks (depending on the outcome) associated with each type of investment.

To further understand whether parents think of these investments as *complements* or *substitutes*, we expand equation (2) and estimate the following specification:

$$y_{ij}^k = \phi_0^k + \phi_1^k I_{Pj} + \phi_2^k I_{Sj} + \phi_3^k I_{Fj} + \phi_4^k I_{Pj} \times I_{Sj} + \phi_5^k I_{Sj} \times I_{Fj} + \phi_6^k I_{Fj} \times I_{Pj} + \gamma_i + u_{ij}^k \tag{3}$$

where the coefficients ϕ_4^k, ϕ_5^k, ϕ_6^k, capture the perceived complementarity or substitutability between the different inputs in the process of child development or for the risks associated to COVID-19.

Importantly, equations (2) and (3) include respondent fixed effects, γ_i: thus, identification is achieved using only within-respondent between-scenario variation. This strategy absorbs idiosyncratic differences across individuals in the responses to the hypothetical questions. For example, different individuals might be thinking of different characteristics for the children and families in the scenarios: all these differences will be absorbed by the within-respondent design, so all that matters is the difference in the level of investments described in each scenario. Using within variation also alleviates the concern that different parents might think of different developmental thresholds to constitute a âGood Level of Developmentâ: we only need parents to be able to think about the differential effectiveness of the three types of investments considered in achieving it.

3.3.3 Beliefs heterogeneity

Equations (2) and (3) estimate *average* beliefs in our sample. To uncover potential heterogeneity in them, and study whether they vary with respondents' observable characteristics, the literature has used two distinct approaches. In the following, we use both approaches and compare the results in the empirical section.

First, we follow Boneva and Rauh (2018) and Attanasio, Boneva, and Rauh (2020), and compute perceived returns and risks for each respondent i. We do so by comparing each individual's answer in the scenario where the level of investment is high, with the corresponding answer in the scenario where the level of investment is low, while holding fixed the levels of all other inputs. For example, we compute

the perceived returns to formal childcare attendance (I^S) for individual i as follows:

$$return_i^S = \frac{(y_{i,A,F,F} - y_{i,N,F,F}) + (y_{i,A,R,F} - y_{i,N,R,F}) + (y_{i,A,F,R} - y_{i,N,F,R}) + (y_{i,A,R,R} - y_{i,N,R,R})}{4} \tag{4}$$

where $y_{i,m,n,l}$ is the outcome reported by respondent i in a scenario with a level m of childcare attendance (A: attend, N: not attend), a level n of parental play (F: frequent, R: rare), and a level l of play with friends (F: frequent, R: rare). As shown in equation (4), when taking the difference we contrast the scenario where the child attends formal childcare, with the corresponding scenario where she does not (i.e., holding fixed the levels of the other investments). In a similar way we compute the perceived returns to parental play ($return_i^P$) and to play with friends ($return_i^F$), and the risks for each type of investment ($risk_i^S$, $risk_i^P$, $risk_i^F$) and each individual in the sample.

The second approach used in the literature to estimate beliefs heterogeneity is via a random coefficients model (Attanasio, Cunha, and Jervis (2019); Cunha, Elo, and Culhane (2022)), which we implement by estimating the following equation:

$$y_{ij}^k = \delta_{0i}^k + \delta_{1i}^k I_{Pj} + \delta_{2i}^k I_{Sj} + \delta_{3i}^k I_{Fj} + u_{ij}^k \tag{5}$$

where y_{ij}^k, I_{Pj}, I_{Sj}, and I_{Fj} have been previously defined, and where we allow for individual-level heterogeneity in the coefficients δ_{0i}^k, δ_{1i}^k, δ_{2i}^k, and δ_{3i}^k. We estimate the random coefficients model using the Swamy (1970) estimator, and compare it to the estimates we obtain using the formula in (4).[10]

3.4 Open-ended questions

To better understand parental beliefs about the returns and risks of different investments in the context of the COVID-19 pandemic, in our survey we further included open-ended questions. These type of questions have recently received more attention by economists (e.g., Ferrario and Stantcheva (2022); Jayachandran, Biradavolu, and Cooper (2023)) to gain a deeper understanding of individual reasoning underlying their behavior. Specifically, at the end of our survey we told respondents *"Please use the space below to express in your own words the main ways the Coronavirus outbreak has affected your life and/or your loved ones so far, and what you think the effects might be in the future. You can write as much or little as you like, and cover any topic you choose"*. As described in Ferrario and Stantcheva (2022), one key advantage of using open-ended questions is that we do not constrain respondents to think about a limited set of options, so we can capture to full breadth of considerations they have in mind.

We use the answers to this question to better characterize the context parents had in mind when responding to our survey: for example, which dimension of child development (as 'Good Level of Development') or health concerns – they considered when thinking about the perceived returns – or risks

[10] The Swamy (1970) estimator proceeds in two steps. In the first step, an OLS regression of equation (5) is estimated for each individual i. The estimates in the first step are used in the second step to obtain the average mean and variance of the coefficients. These are used to obtain an efficient linear estimator of δ_{0i}^k, δ_{1i}^k, δ_{2i}^k, and δ_{3i}^k, following Judge, Judge, Sons, Griffiths, Hill, Lütkepohl, and Lee (1985).

– from different investments?, Or how they perceived different investments to interact in the process of child development?

Over 90% of the sample replied to the open endend question. We perform different types of text analysis on these responses to understand parents' first-order concerns when thinking about the COVID-19 pandemic, in relation to their life and their children. To do so, we proceed in steps. First, we construct *word clouds*, which are useful to quickly visualize the data and to provide information on the most recurring themes. This represents a starting point for a more in-depth analysis (Heimerl, Lohmann, Lange, and Ertl (2014)). In a word cloud, the font size of each element is proportional to the frequency with which that element was mentioned in the open-ended answers.[11] While word clouds are informative about word frequency, they are not appropriate to identify the key topics recurring in the answers.

Therefore, as a second step we conducted *topic analysis* (Blei (2012)). More specifically, we used Latent Dirichlet Allocation (LDA), a hierarchical Bayesian factor model used to extract recurring topics from a given body of text (Blei, Ng, and Jordan (2003)). Intuitively, LDA is similar to principal component analysis, in that it seeks to reduce the dimensionality of the data and to increase its interpretability, while at the same time minimizing information loss. We use the results from the LDA to characterize the type of concerns parents had in mind when reasoning about the risks associated with different types of investments and which was the relevant dimension of child development they considered when thinking about returns.

Third, we performed *sentiment analysis* (SA) of the answers to the open-ended questions. Sentiment analysis is a natural language processing technique used to classify or rate text data to determine the person's attitude and emotional states when writing (Liu et al. (2010)). Among the several methodologies available for quantifying sentiments from text data, here we use the *Lexical methodology*, which relies on a pre-specified set of words, called lexicons or dictionaries, that are associated with particular sentiments. The dictionary we use includes over 10,000 words with an associated sentiment value ranging from -1 to $+1$.[12] We therefore analyze the open-ended questions to characterize the respondents' sentiments when answering the survey by computing a continuous *sentiment index* (where a higher score represents a more positive attitude in the answer). We then investigate whether and how respondent's sentiments relate to individual beliefs about risks and returns.

[11] As a preliminary stage, before conducting any analysis, we cleaned the open-ended answers by removing punctuation, correcting typos and eliminating stop-words (i.e. words carrying no intrinsic meaning such as "and"). We then lemmatized similar words, i.e. grouped them to reduce the number of individual items in the text (e.g. job and jobs, Covid and Coronavirus).

[12] Specifically, we used the *syuzhet* dictionary developed by the Nebraska Literary Lab (Jockers (2017)). See Naldi (2019) for a review of the different dictionaries available.

4 Descriptive evidence

4.1 Childcare use

As mentioned in Section 3, during the first lockdown (23 March to 1 June, 2020) only the children of key workers and the vulnerable children were eligible to attend formal childcare (Department for Education (2020b)). Official data published by the Department for Education shows that the number of children attending early years settings during the first lockdown was approximately 5% of those usually attending during term time; this number rose to 10% by 4 June and to 20% by 25 June 2020 (recall that early years setting were open to *all* children from June 1^{st}). The vast majority of children attending during the first lockdown were children of key workers (87%), and the remainder were vulnerable children. As a consequence of the decreased demand for childcare, as well as to avoid health risks for the carers, two thirds of childcare centres closed during the first lockdown.[13]

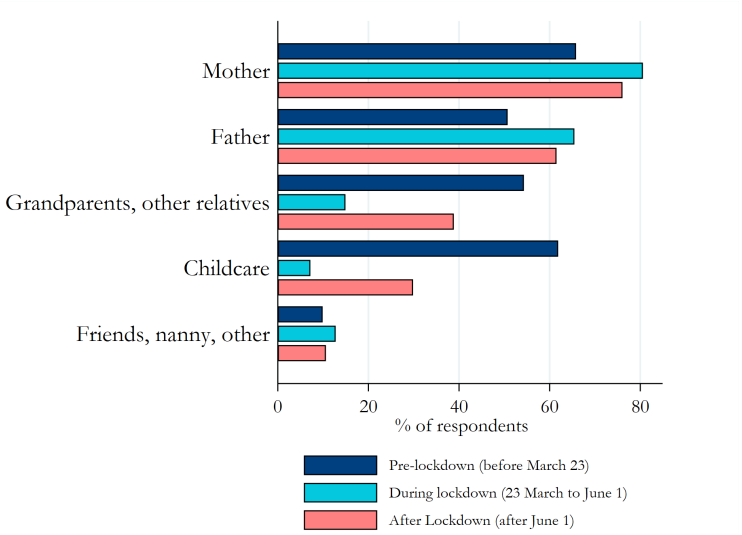
In our survey, we asked respondents whether their children were eligible for attending an early years setting during lockdown, and, if so, whether they attended it. As seen in Table 1, 30% of our respondents were key workers, hence their children were eligible to attend an early years setting; however, only one third of them (hence 7% of the total sample) did so at some point during the lockdown. Our sample, therefore, shows a higher formal childcare attendance during the lockdown compared to the official figures reported by the Department of Education (5%). As mentioned in the data section, key workers are slightly over-represented in our sample, which could partly contribute to the higher attendance rates. When we asked parents of eligible children the reasons for not sending their child to formal childcare (via an open-ended question), the most common answer reflects the fact that parents were concerned about the health risks to their child and their family, but also able to look after their child at home. For example, respondents explained: *"I had concerns over safety and preferred to keep him at home"* and *"I could work from home so deemed it safer to have him with me";* and *"I preferred not to take the risk"*.

Additionally, we asked all respondents a detailed history of different types of childcare arrangements used pre-lockdown, during the first lockdown, and at that point in time in July 2020, post-lockdown. Figure 1 shows the percentage of respondents reporting using each type of childcare at each point in time. The use of formal childcare, such as nursery, preschool, creche, childminder and playgroups, decreased dramatically during the first lockdown.[14] Average attendance in our sample was 62% pre-lockdown, and only 8% during lockdown (the difference in attendance between the two periods is statistically significant at the 1% level, as reported in Appendix Table B1). There was a recovery in the percentage of parents using formal childcare at the end of lockdown, with 30% of parents reporting using it, but formal childcare attendance did not raise back to pre-COVID-19 levels by July 2020 (the time of the data collection). We then asked parents of children not attending formal childcare the reasons for not sending their child back:

[13] Using data from the Department of Education, we report in Panel A of Appendix Figure A1 the number of children attending early years settings during the first lockdown, and in Panel B the number of centres that were closed during the same period.

[14] A childminder is somebody who provides childcare for children in their own home for more than two hours a day. In England childminders must be registered with the Office for Standards in Education, Children's Services and Skills (Ofsted).

Figure 1: Type of childcare usage before, during and after lockdown



Notes: The Figure shows the types of childcare used by respondents at different points in time during the pandemic. Respondents were asked "Does your child currently use and did she/he previously use any of the following options? Please select all that apply" for the periods before lockdown, during lockdown and after lockdown (after June 1, 2020, more precisely at the time of the data collection in July 2020). Dark blue is for before the first lockdown, light blue is for during the lockdown, and the final category is for after the restrictions were lifted (June 2020). The "Grandparents, other relatives" category includes non-resident parents. Childcare refers to nursery, preschool, creche, and childminder ("formal" childcare).

50% of respondents reported fear of infection and contagion as the key reason, and 33% reported that they felt they could handle childcare themselves. In Appendix Figure A2 and Appendix Table B2, we show that the decline in formal childcare use was strong even among children of key workers, who were eligible for childcare throughout the pandemic.[15]

At the same time, the percentage of respondents reporting mothers or fathers as the main childcare providers increased substantially during lockdown: from 65% to 81% for mothers, and from 50% to 65% for fathers. The figures remain significantly higher at the end of the lockdown compared to pre-lockdown levels (Appendix Table B1). Finally, the patterns in Figure 1 are also consistent with the fact that parents acted on the public health message that health risks of COVID-19 to the elderly were much higher than to any other demographic group (Boast, Munro, Goldstein, et al. (2020)). Indeed, the use of grandparents as childcare providers experienced a large reported fall: from 54% pre-lockdown to 14% during lockdown. After the lockdown, in July 2020, this percentage bounced back to 39%.

[15]Specifically, Appendix Figure A2 shows, separately for eligible children (Panel A) and non-eligible children (Panel B), the percentage of respondents reporting using each type of childcare. We observe the same general patterns among these two groups. Pre-lockdown, 84% of eligible respondents reported using formal childcare; this percentage fell to 16% during lockdown. A smaller proportion of the non-eligible group used formal childcare pre-lockdown (48%); this fell to 1% during lockdown, which is expected given that none of the children in this group was eligible for it. For both groups, these differences in the usage pre- and during lockdown are statistically significant at the 1% level (Appendix Table B2). There was a recovery in the percentage of parents using formal childcare at the end of lockdown, but this did not raise back to pre-COVID-19 levels in July 2020. The recovery in childcare usage post lockdown was somewhat stronger among eligible children compared to the non-eligible ones (Appendix Table B2).

Figure 2: Time-use diaries

Notes: Each sub-Figure shows a specific activity the child was doing and whom she was with for each 1-hour interval between 6:00am and 11:00pm for two weekdays: a weekday in April 2020, and a weekday in the week commencing the 6^{th} of July 2020. The top row shows the percentage of respondents who reported their child was engaged in playing, eating/being fed and sleeping over each hour. The bottom row shows the percentage of respondents who reported their child was actively in the company of their mother, father or other children.

4.2 Time-use diaries

In this Section, we present descriptive evidence from the time-use diaries on the different types of activities the child was involved in a typical weekday during and after the lockdown, in April and July 2020, respectively. Figure 2 displays the proportion of respondents who report each activity, for each hour of the day ranging from 6:00 am to 11:00 pm. The routine of the activities playing, sleeping and eating shows patterns that we would expect for this age group: long play time in the morning and afternoon, three distinct meal times at around 8:00, 12:00 and 17:00, the majority of children are asleep between 19:00 and 6:00 and many also have a nap after lunch at around 14:00.[16]

Looking at the differences in time use during and after lockdown, we see that children are spending more time with their parents in April than in July, by a difference of 0.7 hours with the mother and of 0.5 hours with the father (Appendix Table B4 reports regression results). Conversely, children spend 0.3 hours more with other children in July than they did in April; given that our respondents are first-time parents, this is likely to be time spent outside the home. Looking at different activities, we see that on average parents play with the child for roughly 6 hours in April 2020, while they decrease the amount of play time by half an hour in July 2020. Similarly, children are asleep for 0.5 hours less in July after lockdown than they were during lockdown. Finally, there are no differences in the time children spend eating across the two days in April and July.

Figure 2 also plots who the child is spending time with throughout the day, and shows that there are

[16]Summary statistics for the time use variables are reported in Appendix Table B3. In results not reported, we checked whether the day chosen when answering the time use diaries correlated with respondent observable characteristics and found that this was not the case.

important differences between time spent with the mother and the father at both points in time: the time spent with the mother is significantly higher (the average is 12 hours during lockdown) and stable throughout the day, with around 70-80% of respondents reporting that the child is with the mother when awake. The time spent with the father is lower (the average is 6 hours during lockdown), and fluctuates more throughout the day: around 30% of respondents report that the child is with the father during day time, with a 60% peak at 6:00 pm, which is on average the time children are getting ready for bed. The fact that mothers spend twice as much time as fathers in activities with under-fives is consistent with both the evidence reported in Villadsen, Conti, and Fitzsimons (2020) for the first lockdown, and with that reported in Wishart, Dunatchik, Mayer, and Speight (2019) for 2015.[17] The amount of time spent by the child in company of other children is on average very low in both time periods, but - as expected - it is higher in July (0.6 hours) than in April (0.25 hours); since it happens during daytime and the respondents are first-time parents, this is likely time spent playing with other children outside the home.

5 Parental beliefs

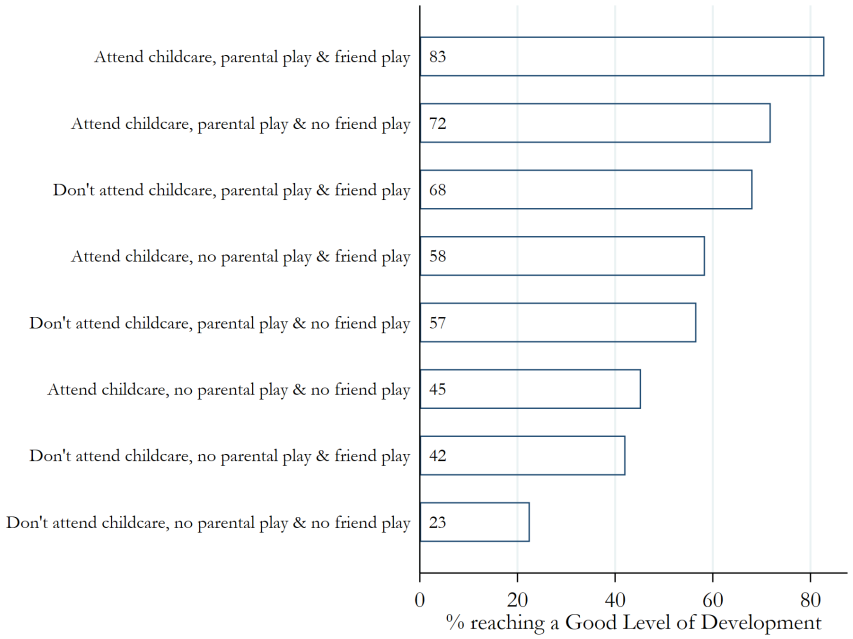
This Section examines parental beliefs about returns and risks to different types of investments, and relate them with respondents' observable characteristics and information from the textual analysis.

5.1 Perceived returns to investment

In Figure 3, we display average responses reported by the parents in each of the eight hypothetical scenarios listed in Table 2 (for brevity we refer to "formal childcare" as "childcare"). Here the outcome variable is the number of children (out of 100) who are expected to reach a Good Level of Development. The pattern of answers is meaningful in the sense that the subjective probability that the child would reach a Goold Level of Development is increasing in investments. More specifically, on average parents believed that only 23% of children would reach a Good Level of Development by September 2020 if all investments were low, while they believed that 83% of them would if all types of investment were high. In Appendix Figure A3, we report the full distributions of individual subjective probabilities for each hypothetical investment scenario: this Figure also shows meaningful patterns in responses. First, subjective probabilities are increasing in the level of investments: moving from Panel a (where all investments are high) to Panel h (where all investments all investments are low), there is a clear shift to the left in the distribution of subjective beliefs (so that the mean decreases as reported in Figure 3); second, the figure shows a considerable heterogeneity in expectations, with answers taking all values between 0 and 100; third the figure displays limited evidence of focal answers.

[17] There are no statistical differences in the time spent on activities by the respondent's gender, but there are statistical differences in the time spent by the child in activities involving only one of the parents. Namely, both male and female respondents report spending more time with the child than their partner (we asked respondents to report both about how much time they spent with their children, and how much time their partners spent). Because we have more mothers than fathers responding to our survey, this might results in an under-reporting of the time fathers are involved with their child. However, such pattern might also be expected if the respondent is the main caregiver (so in cases of male respondents, the fathers would be the main caregivers).

Figure 3: Subjective probability of reaching GLD: average response by scenario



Notes: The figure shows for each scenario the percentage of children that respondents believe would reach a Good Level of Development by September 2020 (asked in July 2020), averaged across respondents. The scenarios are as in Table 2: attend formal childcare yes/no; parental play with child frequent/rare; child play with friends frequent/rare.

Table 3: Perceived returns to investments

	Number of children out of 100 expected to reach a Good Level of Development by September 2020	
	(1)	(2)
Investment: Attend childcare	17.252***	21.317***
	(0.763)	(0.906)
Investment: Parental play	27.862***	32.708***
	(0.770)	(1.006)
Investment: Friends play	13.826***	18.125***
	(0.457)	(0.665)
Friends play × Parental play		-5.079***
		(0.637)
Attend childcare × Parental play		-4.613***
		(0.802)
Friends play × Attend childcare		-3.518***
		(0.644)
Constant	26.468***	23.165***
	(0.647)	(0.747)
Observations	4448	4448
R^2	0.548	0.555
Fixed effects	Yes	Yes

Notes: The dependent variable is the number of children (out of 100) expected to reach a Good Level of Development by September 2020, asked in July 2020. "Investment: Attend childcare" is a binary variable equal to one in the scenario where children are attending a formal childcare setting (versus not attending). "Investment: Parental play" is a binary variable equal to one in the scenario where parents frequently play with the child (versus rare parental play). "Investment: Friends play" is a binary variable equal to one in the scenario where the child frequently plays with friends (versus rare play with friends). All regressions include respondent fixed effects. Standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 reports the estimated coefficients of equations (2) and (3). In the first column, we impose that the interactions between different types of investments are zero, while we allow for complementarity/substitutability between them in column (2). All regressions include respondent fixed effects, and standard errors are clustered at the respondent level.

First, consistently with Figure 3, we notice that on average parents believe that if all types of investment were low, only 23-26% of children would reach a Good Level of Development by September 2020 (the constant term in column 1 and 2). Parents also perceive that formal childcare attendance, parental play and play with friends all improve child development: formal childcare attendance is believed to increase the proportion of children reaching a Good Level of Development by 17 percentage points (65 percent); similarly, frequent parental play and frequent play with friends are believed to increase the share of children with a Good Level of Development by 28 percentage points (105 percent) and 14 percentage points (50 percent), respectively. Therefore, although all activities are perceived to improve child development, respondents believe that parental play has a significantly larger effect than formal childcare attendance or play with friends (these differences are statistically significant at the 1% level).

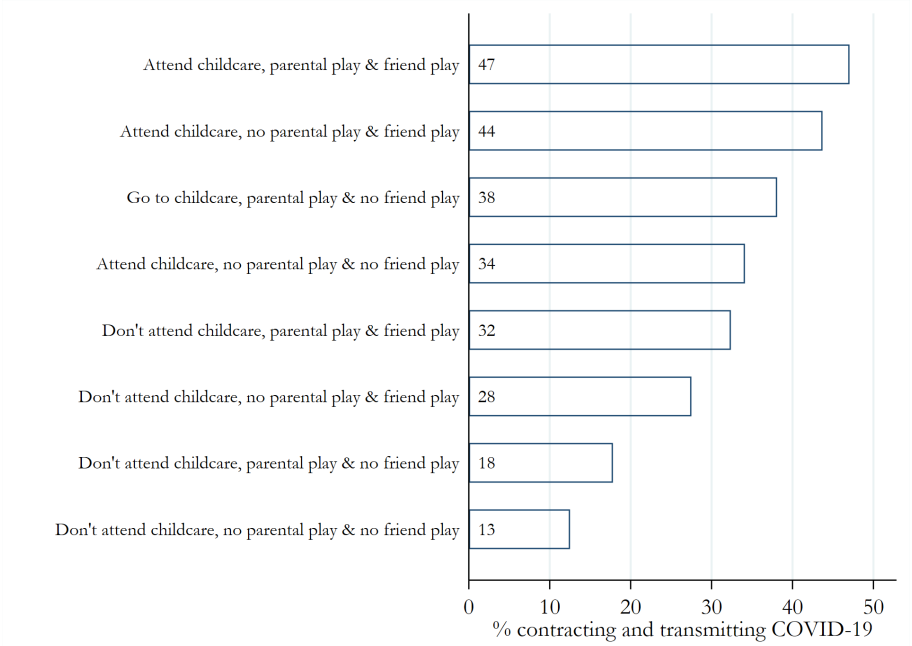
Column 2 of Table 3 reports negative and significant coefficients on the interactions between the various type of investments. This implies that respondents believe that parental play, play with friends, and formal childcare attendance are partially substitute activities: for example, parents believe that childcare attendance is more productive for a child who receives little stimulation from their parents through play; similarly, a high level of parental play is more important for children who play rarely with friends. These results also suggest that parents believe they can substitute formal childcare and play with friends by increasing their own time with the child.

5.2 Perceived risks of investment

Figure 4 presents average perceived probabilities of catching and transmitting COVID-19 by September 2020 for each of the eight hypothetical scenarios. On average, parents believed that 13% of children would contract and transmit COVID-19 by September 2020 if all investments were low; this figure would increase to 47% when all types of investment were high. In Appendix Figure A4, we report the full distributions of individual subjective probabilities for each hypothetical investment scenario. The Figure also shows meaningful patterns in responses: for example, the distribution of subjective beliefs of catching and transmitting COVID-19 is more concentrated around zero in scenarios that involve limited social interactions (e.g., panels e, g and h), compared to scenarios that involve more social interactions (e.g., panels a, b and d); the figure also shows limited evidence of focal answers in parental responses.

Table 4 reports the estimated coefficients of equations (2) and (3). As before, in the first column we impose that the interactions between different types of investments are zero, and we allow for complementarity/substitutability between them in column (2). All regressions include respondent fixed effects, and standard errors are clustered at the respondent level. Respondents believe that attending formal childcare, frequent play with parents, and frequent play with friends all increase the likelihood of contracting and transmitting COVID-19: by 18 percentage points, 4 percentage points and 12 percentage points, respectively. The perceived risk of catching and transmitting COVID-19 associated with formal childcare attendance is more than four times as large as the perceived impact of parental play; this differ-

Figure 4: Subjective probability of catching and transmitting COVID-19: average response by scenario



Notes: The figure shows for each scenario the percentage of children that respondents believe would contract and transmit COVID-19 by September 2020 (asked in July 2020), averaged across respondents. The scenarios are as in Table 2: attend formal childcare yes/no; parental play with child frequent/rare; child play with friends frequent/rare.

ence in perceived risks is significant at the 1% level; play with friends is also perceived to be significantly riskier than parental play (this difference is also significant at the 1% level), but not as risky as attending childcare.

Table 4: Perceived risks to investments

	Number of children expected to contract and transmit COVID-19 by September 2020	
	(1)	(2)
Investment: Attend childcare	18.202***	21.649***
	(0.762)	(0.949)
Investment: Parental play	4.358***	5.323***
	(0.389)	(0.500)
Investment: Friends play	12.054***	15.070***
	(0.525)	(0.726)
Friends play × Parental play		-0.533
		(0.426)
Attend childcare × Parental play		-1.397***
		(0.456)
Friends play × Attend childcare		-5.497***
		(0.606)
Constant	14.364***	12.507***
	(0.614)	(0.705)
Observations	4448	4448
R^2	0.416	0.423
Fixed effects	Yes	Yes

Notes: The dependent variable is the number of children out of 100 expected to catch and transmit COVID-19 by September 2020 asked in July 2020. "Investment: Attend childcare" is a binary variable equal to one in the scenario where children are attending a formal childcare setting (versus not attending). "Investment: Parental play" is a binary variable equal to one in the scenario where parents frequently play with the child (versus rare parental play). "Investment: Friends play" is a binary variable equal to one in the scenario where the child frequently plays with friends (versus rare play with friends). All regressions include respondent fixed effects. Standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Turning to the interaction terms, we find that, conditional on childcare attendance, parents believe that the likelihood of catching and transmitting COVID-19 would decrease if they play with their child more frequently; this may be because parents perceive increased parental play to be crowding out other riskier activities: for example, parents might believe that the child would be attending childcare more often or for longer periods of time if they played with her rarely.[18] We find a similar result for the interaction between childcare attendance and play with friends; on the other hand, we find no significant interaction between parental play and play with friends.

5.3 Heterogeneity in perceived returns and risks

Tables 3 and 4 present *average* beliefs about returns and risks in our sample. As shown in Appendix Figures A3 and A4, this masks substantial heterogeneity in responses to the subjective probability questions. Following the procedure outlined in Section 3.3.2, we therefore compute for each respondent in our sample her individual-specific perceived risk and return associated with each type of investment: $return_i^S$, $return_i^P$, $return_i^F$ and $risk_i^S$, $risk_i^P$, $risk_i^F$ (see equation (4)).

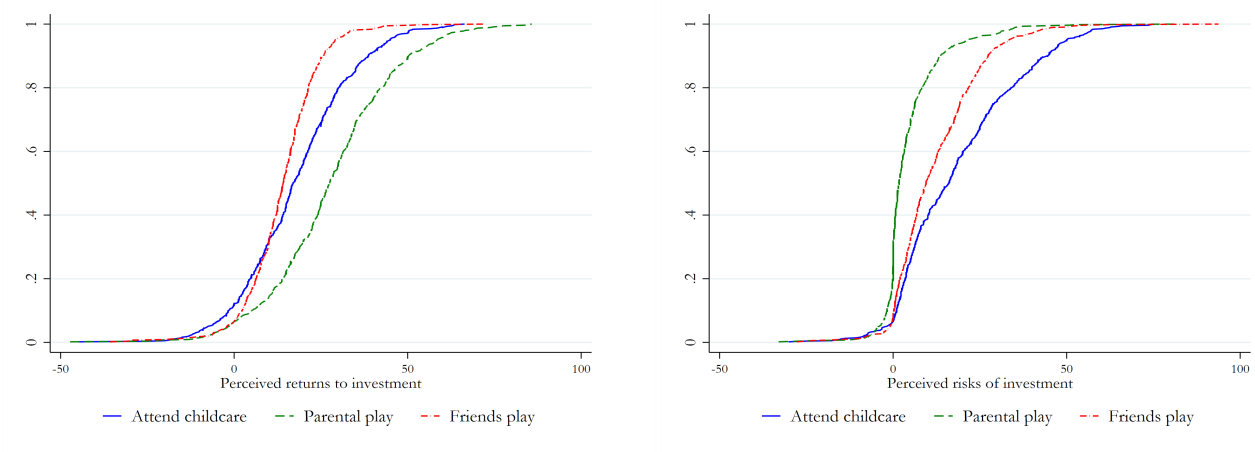
We report the cumulative distributions of individual beliefs in Figure 5: the left panel reports the distribution of perceived returns, and the right panel the distribution of perceived risks. Several patterns emerge. First, consistent with the wide heterogeneity in the answers to the subjective probability questions, there is a substantial degree of heterogeneity in the beliefs about the returns and risks of different types of investment in our sample, with a minority of parents also perceiving negative returns: for example, the expected return from childcare attendance is 7.5 at the 25th percentile and 28 at the 75th percentile; similarly, the expected risk associated with childcare attendance is 4.88 at the 25th percentile and 29 at the 75th percentile.

Second, the distribution of perceived returns associated with parental play first-order stochastically dominates that of play with friends or childcare attendance (Panel A); at the same time, parental play is also perceived to increase the risk of catching and transmitting COVID-19 the least (Panel B). Third, we note that the distribution of perceived risks associated with parental play has a large mass at zero, implying that most parents believe that this is essentially a risk-free activity. Finally, play with friends is perceived to improve child development the least, but to increase the risk of catching and transmitting COVID-19 less than attending formal childcare.

Given these results, parental play appears to be the most productive investment to improve child development, while at the same time limiting the health risks associated with COVID-19. These results help rationalising the evidence on parental childcare choices during the pandemic: more specifically, our finding that parents perceive formal childcare attendance to be substantially riskier than time spent with them is consistent with the evidence showing that public school enrollment declined sharply during the pandemic (even when schools were open to all students), and homeschooling increased noticeably during

[18] We cannot test this directly because we did not collect information on perceived returns and risk at the intensive margin of childcare use.

Figure 5: Cumulative distributions of individual beliefs of returns and risks



(a) Returns

(b) Risks

Notes: The Figure plots the cumulative distribution of individual perceived returns in terms of Good Level of Development (GLD, Panel A) and risks of investments in terms of likelihood of catching Covid-19 (Panel B), computed as in equation (4).

the same period (Cattan et al. (2021), Musaddiq, Stange, Bacher-Hicks, and Goodman (2022)).

We further investigate the correlations between individual perceived returns and risks of different types of investment. In Appendix Table B5 we find that the perceived returns are not very correlated, with the exception of the returns to parental play and play with friends, which are positively correlated (significant at the 1% level): parents who believe that playing with their child has a higher return also perceive a higher return to playing with friends. On the other hand, perceived risks seem to be more strongly correlated: a respondent who perceives a high risk for any type of investment is also more likely to perceive other investment options to be riskier (the correlation coefficients are all significant at the 1% level). This latter result might be explained by the individual-level heterogeneity in the perceived risks associated with the severity of the COVID-19 pandemic and the infectiousness of the virus (Akesson et al. (2022), Fan et al. (2020)): this heterogeneity across respondents translates - at the individual level - in a high correlation in perceived risks across different types of investment.[19]

Finally, we compare individual beliefs computed using the two procedures described in Section 3.3.2. Appendix Figure A7 reports the estimated cumulative density function of the Swamy (1970) estimates of the random coefficient model (equation 5) for perceived returns (Panel A) and risks (Panel B), alongside the empirical CDF for perceived returns and risks resulting from formula (4). The figure shows that the two distributions are virtually identical. Appendix Figure A8 further shows the scatter plot of individual perceived returns (Panel A) and risks (Panel B) for formal childcare attendance computed using the two methods: there is a strong linear relation between the two estimates, demonstrating (reassuringly) that the two approaches used in the literature produce consistent results.

[19] In Appendix Figure A5 we also report, for each type of investment, the joint distribution of the associated perceived risks and returns; in Appendix Figure A6 we report the joint distribution of returns (Panel A) and risks (Panel B) for any two types of investment.

5.4 Correlation between beliefs and respondents' characteristics

5.4.1 Demographic and socio-economic characteristics

Next, we investigate whether the perceived returns and risks vary with the characteristics of the respondent, in particular with socioeconomic status, as proxied by their level of education. In Table 5, we present OLS results from a regression of the individual-specific measures of returns (Panel A) and risks (Panel B) computed using equation (4) on observable characteristics of the respondent; each column reports the results for the outcome variable indicated in the header. Without information about the *actual* production function, and how it varies between groups (e.g., lower- and higher-SES parents), we cannot say if beliefs are more closely aligned with actual returns for certain parents. For example, it might be that parents' time is more productive and thus has a higher return for better educated parents: in this case, higher beliefs for more educatied parents might be not the result of misinformation, but simply aligned with actual returns. In this Section, we simply report correlations between perceived returns and risks and observable demographic and socio-economic characteristics of the respondents.

Several patterns emerge. First, consistently with previous findings (e.g. Boneva and Rauh (2018); Attanasio, Cunha, and Jervis (2019); List, Pernaudet, and Suskind (2021)), we document that lower-SES respondents perceive lower returns from parental play. More specifically, our point estimates suggest that there is a gradient in perceived returns to parents' play: parents with further, higher, or a postgraduate education perceive these returns to be 23%, 34% and 31% higher than parents with GCSE-level or lower education (column 2, Panel A of Table 5). However, we do not find statistically significant differences in the perceived returns to formal childcare or to play with friends by respondent's education, although the coefficient are always positive for more educated parents. At the same time, compared to higher-SES ones, lower-SES respondents perceive a significantly lower risk of catching COVID-19 from formal childcare attendance (Panel B column 1 of Table 5): for example, compared to a respondent with the lowest level of education, a parent who has completed higher education perceives the risk of childcare attendance to be 6 percentage point higher (at the mean this corresponds to a 32% increase).

Second, respondents who were already using formal childcare pre-pandemic perceive significantly higher returns and lower risks from childcare attendance; these same respondents also perceive a lower risk associated with play with friends – an activity that requires interactions with other children. Third, consistently with the fact that key workers were allowed to continue working outside their homes throughout the first lockdown, and were therefore potentially more exposed to the virus, we find that these respondents perceived parental play to be a riskier activity compared to non-key workers.

We test the robustness of these results to the inclusion of additional child and respondent characteristics in Appendix Table B6. We first add race and gender of the respondent, sex and age of the child, and quality of the early years settings available to the respondents at the Local Authority level, as measured by the Office for Standards in Education (OFSTED).[20] We show that the results are qualitatively the

[20]The Office for Standards in Education (OFSTED) typically inspects the quality of early years settings every year and gives an inspection rating on a four-point scale: 1: outstanding, 2: good, 3: requires improvement, and 4: inadequate. The

Table 5: Determinants of perceived returns and risks

	Panel A: Returns		
	Formal childcare	Parental play	Play with friends
	(1)	(2)	(3)
Respondent education: Further	2.852	6.524**	2.185
	(2.773)	(3.139)	(2.400)
Respondent education: Higher	0.302	9.689***	2.624
	(2.591)	(2.936)	(2.336)
Respondent education: Postgraduate	0.332	8.838***	1.130
	(2.800)	(3.197)	(2.428)
Female respondent	-2.434	-1.684	1.382
	(1.760)	(1.952)	(1.136)
Key worker	0.971	-2.605	-0.654
	(1.439)	(1.641)	(0.985)
Attended childcare pre-pandemic	7.331***	-0.989	-1.136
	(1.285)	(1.539)	(0.896)
Observations	554	554	554
Unconditional mean outcome	17.974	27.986	13.963
R^2	0.060	0.028	0.012
	Panel B: Risks		
	Formal childcare	Parental play	Play with friends
	(4)	(5)	(6)
Respondent education: Further	5.989**	1.524	-0.361
	(2.742)	(1.625)	(2.782)
Respondent education: Higher	6.131**	1.351	0.027
	(2.531)	(1.531)	(2.707)
Respondent education: Postgraduate	4.108	0.229	-0.911
	(2.771)	(1.572)	(2.838)
Female respondent	2.526	-1.612	1.081
	(1.771)	(1.175)	(1.317)
Key worker	-1.851	1.581*	-0.611
	(1.601)	(0.881)	(1.145)
Attended childcare pre-pandemic	-3.405**	-0.224	-2.557**
	(1.443)	(0.796)	(1.042)
Observations	552	552	552
Unconditional mean outcome	18.604	4.428	12.179
R^2	0.025	0.016	0.013

Notes: Each column displays results from a separate regression. The dependent variables are individual perceived returns (Panel A) and risks (Panel B) associated with each type of investment (indicated in the column header). These are computed as in equation (4). Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

same, with the exception of the perceived returns to play with friends, for which we uncover a more pronounced gradient by socio-economic status: more educated parents perceive statistically significantly higher returns from their child playing with friends than lower educated ones. Appendix Table B6 also shows that, differently from Attanasio, Boneva, and Rauh (2020) who find no differences in perceived returns by the gender of the child for a sample of parents in England, we find that respondents perceive, on average, lower returns to parental play in case their child is a boy. At the same time, we find no heterogeneity in perceived returns and risks by respondents' gender (but we note that this might be due to the small proportion of male respondents in our sample).

Using data from the Office for National Statistics, we further examine whether perceived returns and risks are associated with the number of COVID-19 cases (measured in the two weeks before the survey) in the Local Authority where the respondent resided: we find that this is generally not the case (Appendix Table B7).[21] We also find that the relationship between the number of COVID-19 deaths (measured in the

OFSTED data is publicly available. The ratings are at the provider level; for the analysis, we aggregate them and use the average rating in the Local Authority where the respondent resided, since we did not ask the name of the early years setting attended.

[21]The Office for National Statistics data is available here: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases#datasets.

two weeks before the survey) and parental beliefs goes in the expected direction, with parents perceiving lower returns and higher risks from investments when the number of COVID-19 deaths are higher in the Local Authority where they reside, although the coefficients are imprecisely estimated (Appendix Table B7).

5.4.2 Characterizing parental beliefs using text data

To better interpret the beliefs data in the context of the COVID-19 pandemic, we turn to the analysis of the open ended question. Panel A of Figure A9 shows the word cloud of the most popular words used in the answers. Respondents often mention the words "work", "child", "family", "time", "social", "worry", "coronavirus", "friends", and "development". To better understand the most recurring *topics*, we present the results from the Latent Dirichlet Allocation (LDA) in Panel B of Figure A9. We identify three main topics from the text data. The first topic evokes concerns related to family life during lockdown, and about the future. The second topic is related to work and childcare arrangements during the lockdown, while the third is specifically related to the children and to concerns regarding their development. Inspection of individual answers reveals that most parents mention social and emotional development as the key dimension of concern, and believe that the lack of socialization brought about by the lockdown would negatively impact their child social skills and ability to interact with others. For example, some respondents stated: "*I am concerned about the lack of interaction with other children for social learning with an only child*", "*It really affected my son being off nursery, missing the social interaction. I found it hard to get him to focus on the schoolwork that was sent for him to do. I hope that his behaviour improves when he settles back to nursery*", and *"I worry about the lack of socialisation for my son the most, he has become very clingy and dependent of us (his parents) over lockdown to the point he won't sleep in his own bed anymore"*.[22] The textual data further confirms that parents perceived they could substitute formal childcare with their own time, as suggested by the results in Table 3. We further use the textual data to understand what type of concerns parents had in mind when considering the risks associated with COVID-19: we find that 56% of parents were worried about their own health or that of another family member, and 18% about their child's health only.

Finally, we examine whether the sentiment score computed from the text data relates to perceived returns and risks. We find that, on average, a higher sentiment score is associated with higher perceived returns, particularly for play with friends; on the other hand, we do not find any systematic relationship between the sentiment score and perceived risks (Appendix Table B8).[23] This result aligns well with recent evidence on the key role of parental mental well-being in explaining investment decisions in children (Baranov, Bhalotra, Biroli, and Maselko (2020)), and is consistent with research in clinical psychology showing that, by distorting beliefs, mental health can affect the way people think and behave (Gotlib

[22] Concerns about the child social development are not uncommon: for example, Byrne et al. (2022) document worsening social communication skills in children born during the lockdown as compared to a historical cohort in Ireland, on the basis of parental reports; Hughes et al. (2023) find that children with siblings are able to adjust better to lockdown restrictions.

[23] The table report results by terciles of the empirical distribution of the sentiment score. Alternative specifications of the sentiment score (median split, using quartiles, or a continuous measure) produce qualitatively similar results.

and Joormann, 2010).

6 Do beliefs predict investment decisions?

The final question we address is whether actual investment decisions made by parents are correlated with their beliefs about the returns and risks of such investments. We stress, however, that we do not interpret any correlations between beliefs and parental behavior as a causal effect of beliefs on choices. Following the theoretical framework in Section 2, we model parents' investments decisions in terms of a trade-off between the perceived risks of catching and transmitting COVID-19 and the perceived returns for their child's development.

6.1 Descriptive evidence

In Table 6, we present simple OLS regressions of realized choices on elicited beliefs about the risks of, and returns to, different investments (controlling for respondent's observable characteristics). We uncover several correlations that go in the expected directions. First, a higher perceived return to formal childcare is positively associated with its use; on the other hand, a higher perceived risk to formal childcare is negatively associated with its use (column 1). Second, looking at the time parents spend playing with the child from the time use diaries (columns 2 to 4), we find that parents who perceived a higher return to parental play were more likely to spend time with their child in July 2020; this is true both if we look at general child play (column 2), and if we look at the time spent by the mother or the father actively playing with the child (columns 3 and 4). Third, we find that a higher perceived return to play with friends is significantly positively associated with playground use in July (column 5). At the same time, a higher perceived risk of play with friends is negative correlated with the likelihood of going to the playground. Fourth, a higher perceived return to play with friends and a higher risk of formal childcare attendance are, respectively, negatively and positively associated with more time spent playing with the mother, but not with the father. This last result echoes the vast evidence documenting the increased burden on women's time experienced during the pandemic as consequence of limited availability of alternative childcare options (see e.g. Sevilla and Smith (2020)). These findings show that parental choices are correlated not only with the perceived benefits (as shown in, among others, Attanasio, Boneva, and Rauh (2020)), but also with the perceived risks associated with different types of investments.

Interestingly, the results in Table 6 also show that the gradients in the time the mother and the father spend in active play with the child go in opposite directions: respondents with higher levels of education report that in their household the mother spends *less* time actively playing with the child (column 3), while the father spends *more* time in this activity (column 4), as compared to those with lower levels of education. While the greater involvement in childcare of more educated fathers has been previously shown (Dotti Sani and Treas (2016); Sundström and Duvander (2002)), the finding that more educated mothers spend more time with their children (Kalil, Ryan, and Corey (2012); Guryan, Hurst,

Table 6: Parental beliefs and actual investments

	Formal childcare attendance	Play	Play-actively involved mother	Play-actively involved father	Playground use
	(1)	(2)	(3)	(4)	(5)
Return to childcare	0.007***	-0.010	-0.016**	-0.013**	0.002
	(0.001)	(0.008)	(0.008)	(0.006)	(0.004)
Return to parental play	0.001	0.017**	0.013**	0.012**	-0.002
	(0.001)	(0.007)	(0.007)	(0.006)	(0.003)
Return to play with friends	-0.001	-0.032**	-0.023*	-0.013	0.015***
	(0.002)	(0.013)	(0.012)	(0.010)	(0.006)
Risk of childcare	-0.004***	0.002	0.016**	0.003	0.005
	(0.001)	(0.008)	(0.007)	(0.006)	(0.004)
Risk of parental play	-0.001	-0.013	-0.019	-0.006	-0.003
	(0.002)	(0.012)	(0.012)	(0.009)	(0.006)
Risk of play with friends	-0.000	0.011	0.011	-0.004	-0.016***
	(0.001)	(0.013)	(0.011)	(0.009)	(0.005)
Respondent education: Further	0.071	-0.084	-0.441	0.680*	0.252
	(0.064)	(0.487)	(0.502)	(0.355)	(0.233)
Respondent education: Higher	0.034	-0.127	-0.554	0.607*	0.082
	(0.060)	(0.468)	(0.476)	(0.329)	(0.220)
Respondent education: Postgraduate	0.109	-0.355	-1.058**	0.718**	0.640**
	(0.067)	(0.504)	(0.507)	(0.355)	(0.281)
Female respondent	0.019	-0.576*	0.404	-1.744***	-0.129
	(0.044)	(0.314)	(0.297)	(0.278)	(0.158)
Key worker	0.125***	0.450*	0.260	0.316	0.006
	(0.042)	(0.273)	(0.263)	(0.215)	(0.133)
Observations	548	548	547	547	548
Unconditional mean outcome	0.241	5.338	4.055	1.976	0.777
R^2	0.109	0.033	0.046	0.125	0.042

Notes: The dependent variables are: an indicator variable for whether the child attends formal childcare in July 2020 (column 1), the number of hours the child spent playing in the July time use diary (column 2), the number of hours the respondent reported the mother spent actively playing with her child in the July time use diary (column 3), the number of hours the respondent reported the father spent actively playing with her child in the July time use diary (column 4), and the number of times the child was taken to the playground in a week in July 2020 (Column 5). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

and Kearney (2008)) does not seem to be replicated in our setting.

We further study whether the associations between parental beliefs and investments seen in Table 6 vary by the age of the child, by splitting the sample at 3 years old; the results are presented in Appendix Table B9. We do so both to account for different developmental stages, and also because of institutional reasons: in England, at the time of our study, parents of children aged 3-4 were entitled to up to 30 hours of free childcare per week (for 38 weeks of the year), while parents of children aged 0-3 were only entitled to free childcare if they satisfied certain eligibility criteria, such as receiving means-tested benefits.[24] We might therefore expect older children to be much more likely to be in formal childcare by the time of the survey: indeed, we see that the mean childcare attendance is twice as large for the older children than for the younger ones (0.368 versus 0.210, respectively); along the same lines, the number of hours the mother and the father spend actively playing with the child is slightly lower among older children (3.524 vs 4.181 and 1.876 vs 2 hours for the mother and the father, respectively). For these reasons, considerations about returns and risks might be more salient for parents of younger children: indeed, Table B9 shows that returns to, and risks of, formal childcare attendance appear more predictive for parents of younger children.

Lastly, given that previous evidence suggests that resource constraints might matter to explain the

[24] See https://www.gov.uk/30-hours-free-childcare and https://www.gov.uk/help-with-childcare-costs/free-childcare-2-year-olds.

correlation between individual beliefs and realized choices (e.g., Delavande, Del Bono, and Holford (2022)), in Appendix Table B10 we further study whether the relation between parental beliefs and investments is heterogeneous across higher- and lower-SES respondents. Unfortunately, in our survey we did not directly collect information on whether parents faced financial constraint in their ability to invest: therefore, we assume that lower-SES parents are more constrained than higher-SES ones, and report heterogeneous results along this dimension. The results in Appendix Table B10 show indeed evidence of heterogeneity by parental education: the association between perceived returns to parental play and the time spent by parents (especially mothers) playing with the child is positive and statistically significant for higher-SES parents but not for lower-SES ones; at the same time, the relation between perceived returns and perceived risks of childcare and actual childcare use is similar across the two groups. We find little evidence of heterogeneity by parental education in the relationship between beliefs and choices for the other dimensions of investment.

6.2 A discrete choice model of parental investments

The results in Table 6 consider each investment decision in isolation. However, as outlined in the theoretical model, these decisions are likely to be made simultaneously by the parent and to be interrelated. To account for this, in this last section we combine data on parents' subjective beliefs and on their choices of investment to estimate the model outlined in Section 2.

6.2.1 Empirical specification

In the model, the parent chooses the combination of investments I_{Si}, I_{Pi}, I_{Fi} that maximizes her utility given her subjective beliefs about returns to, and risks of, investments. The probability that the parent chooses investment levels $I_{Si} = a_1, I_{Pi} = a_2, I_{Fi} = a_3$ conditional on her subjective beliefs Ψ_i and Ω_i is:

$$Pr(I_{Si} = a_1, I_{Pi} = a_2, I_{Fi} = a_3 | \Psi_i, \Omega_i) =$$
$$Pr[EU_i(a_1, a_2, a_3) > EU_i(b_1, b_2, b_3)] \quad \forall (a_1, a_2, a_3) \neq (b_1, b_2, b_3) \tag{6}$$

To estimate the model and relate it to the survey design, we make the following assumptions. First, we assume that the parent enjoys utility level τ if her child reaches a Good Level of Development and zero otherwise, so that $u(K_i) = \tau \ \mathbb{1} \ (K_i > GLD)$.[25] Second, we assume that the disutility cost, which we denote δ, is incurred by the parent only if her child catches and transmits COVID-19, so we write $v(COVID_i) = -\delta \mathbb{1}(COVID_i = 1)$. Third, for simplicity and in line with the survey design, we assume that parents can select only two levels of investment for I_{Pi} and I_{Fi}: F (frequent) or R (rare). Similarly, we assume that the childcare attendance choice I_{Si} is binary: the parent can either send her child to childcare A (attend) or not N (no attend).

[25] Notice that assuming the parents derive zero utility is without loss of generality. We could set the utility level that the parents receives from her child *not* reaching a Good Level of Development to any other positive constant.

Assuming that the error term in (1) is independent for every individual and alternative and that it has a Type I extreme value distribution, the model can be estimated using a multinomial logit with eight alternatives given by different combinations of the various types of investment reported in Table 2: $(N,R,R),(N,R,F),(N,F,R),(N,F,F),(A,R,R),(A,R,F),(A,F,R),(A,F,F)$. In our data we define "Frequent" parental plays and "Frequent" play with friends if the number of hours spent on these activities is above the median and "Rare" otherwise. Note that the model allows us to make inference about the preference parameters τ and δ, exploiting variation in expected returns and risks across alternatives and parents; this exercise also reveals whether heterogeneity in perceived risks and returns across alternatives and parents matter to explain the observed patterns of parental behavior we see in our data.

6.2.2 Results

Table 7 reports the results of the multinomal logit model. Columns 1 and 2 report the model estimates on the sample of all respondents, while columns 3-4 use only high-SES respondents and columns 5-6 only low-SES respondents. The coefficient on respondent's subjective beliefs about the returns to investment in column 1 is positive and statistically different from zero. This suggests that parents' beliefs matter to explain investment choices *and* that parents value positively child development outcomes (τ is positive). At the same time, the estimate value of δ is negative and statistically significant, which suggests that higher perceived risks are associated with a decrease in the likelihood of selecting specific investment strategies *and* that parents incur a utility cost from COVID-19 infection. The model estimates in column 2 (where we control for the respondent's observable characteristics) are very similar to the ones reported in column 1 (where we only include subjective beliefs), suggesting that, controlling for perceived returns and risks, such observable characteristics have a modest effect on the choice of investments.

Table 7: Discrete Choice Model Estimates

	All respondents		High-SES		Low-SES	
	(1)	(2)	(3)	(4)	(5)	(6)
τ	1.166***	1.270***	1.717***	1.900***	1.052***	1.103***
	(0.270)	(0.278)	(0.631)	(0.667)	(0.299)	(0.309)
δ	-0.907***	-0.927***	-0.760	-0.818	-0.931**	-0.974**
	(0.347)	(0.355)	(0.802)	(0.815)	(0.383)	(0.392)
Observations	4464	4464	960	960	3504	3504
Controls	No	Yes	No	Yes	No	Yes

Notes: The table reports the estimates of the multinomial logit with eight alternatives $(N,R,R),(N,R,F),(N,F,R),(N,F,F),(A,R,R),(A,R,F),(A,F,R),(A,F,F)$. τ is the preference over child development, while δ is the preference over COVID-19 as outlined in Section 6.2.1. Columns 1 and 2 report the results using the whole sample. Columns 3 and 4 report the results using only high-SES respondents (defined by the respondent having above higher education). Columns 5 and 6 report the results using only low-SES respondents (defined by the respondent having below or equal to higher education). Odd columns do not include additional controls, while even columns do (same set of controls reported in Table 6). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Comparing the model estimates in Column 1 with those reported in Columns 3 and 5, we confirm our earlier results that the relation between beliefs and choices is relative homogeneous for lower- and higher-SES parents, suggesting that heterogeneity in preferences between parents play a limited role in explaining variation in investment behavior, while heterogeneity in beliefs seem to play a key role. Again, the model estimates in columns 4 and 6 (where we control for observable characteristics of the

respondents) are very similar to the ones reported in columns 3 and 5, respectively.

7 Conclusions

We have presented novel evidence on the role of beliefs about returns to, and risks of, different types of investments in children in presence of heightened health risks, at the beginning of the coronavirus pandemic. Our paper contributes to the growing literature studying the role of subjective beliefs about the *returns* to parental investments and how these affect behaviour (e.g., Cunha, Elo, and Culhane (2013, 2022); List, Pernaudet, and Suskind (2021)); it also shows that, at a time of high uncertainty due to the COVID-19 pandemic, individual perceived *risks* from different types of investments are equally important in the household decision making process. We have collected new data on first-time parents of under-fives during the first COVID-19 wave in England. Our rich survey includes measures of subjective beliefs on the returns to, and risks of, three different types of investments (formal childcare attendance, parental play, and child play with friends), detailed time use data on children's daily activities, and open-ended questions.

Several key results have emerged. First, we have documented that - consistently with official figures - the use of formal childcare decreased significantly since the start of the first lockdown, at the end of March 2020. We have also shown that, despite the reopening of early years settings in June 2020, their use did not increase to pre-lockdown levels in summer 2020: the analysis of textual data suggests that, although the lack of socialization was a key concern for many parents, they perceived they could partly substitute childcare with their own time investments.

Second, we have found that respondents believed that formal childcare, parental play, and play with friends all improve child development; at the same time, each activity is perceived to increase the risk of contracting COVID-19. On average, parental play is perceived to improve child development the most, and to increase the likelihood of catching COVID-19 the least: the analysis of beliefs data demonstrates that parents perceive their own time to be a partial substitute for formal childcare, consistently with the open-ended questions on the reasons for not sending the child to an early years setting.

Third, we have documented a significant socioeconomic gradient in beliefs, with lower-SES respondents generally perceiving lower returns to parental play and lower health risks from formal childcare attendance. Using natural language processing techniques to analyse the open-ended questions, we have further shown that parents who expressed greater concerns and more negative feelings in their answers generally perceived lower returns from human capital investments.

Finally, we have shown that the perceived returns and risks associated with different types of investments are predictive of actual choices: parents who perceived a greater return to formal childcare were more likely to send their child to childcare in summer 2020; conversely, a larger perceived health risk of sending the child to formal childcare has a significant negative association with its use: at the same time, a higher expected benefit from parental play is associated with more time spent playing with the child.

Estimates from our discrete choice model further suggest that parents place a positive utility weight on their children's human capital outcome and a negative utility weight on COVID-19 infection, but we find limited evidence of heterogeneity in preferences across higher- and lower-SES parents, suggesting that heterogeneity in beliefs played a key role in explaining variation in investments.

These last two results are important: they suggest that beliefs heterogeneity by socio-economic status could contribute to further widening of pre-existing inequalities in early years development, and are consistent with recent evidence demonstrating differential impacts of the pandemic on children's learning outcomes by socioeconomic status (Engzell, Frey, and Verhagen (2021); Maldonado and De Witte (2021)). Our findings remark the importance of studying the sources of parental beliefs, and suggest the need for timely and targeted provision of information on the actual returns and risks to different forms of investments - fruitful avenues of future investigations.

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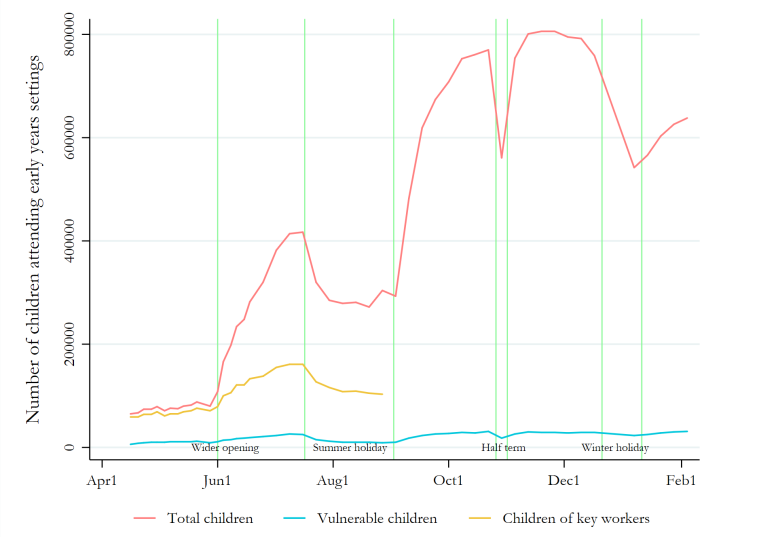
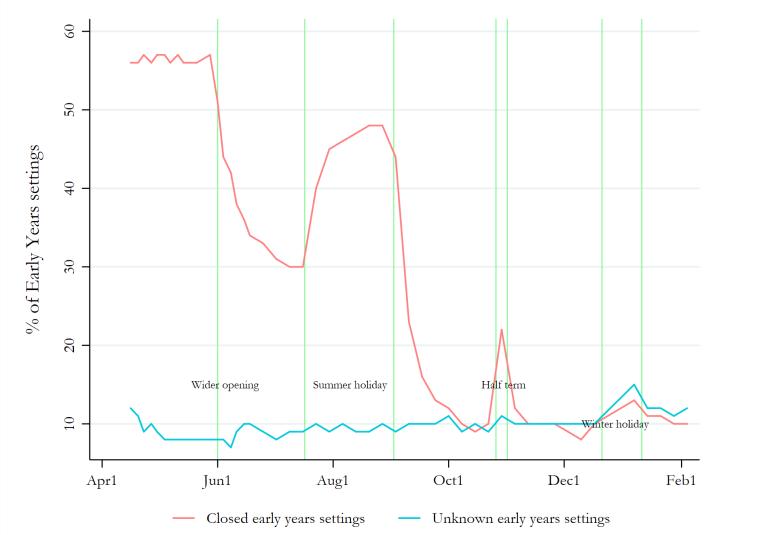
Appendix

A Appendix Figures

Figure A1: Early years settings in England during the first year of COVID-19 (April 2020-February 2021)



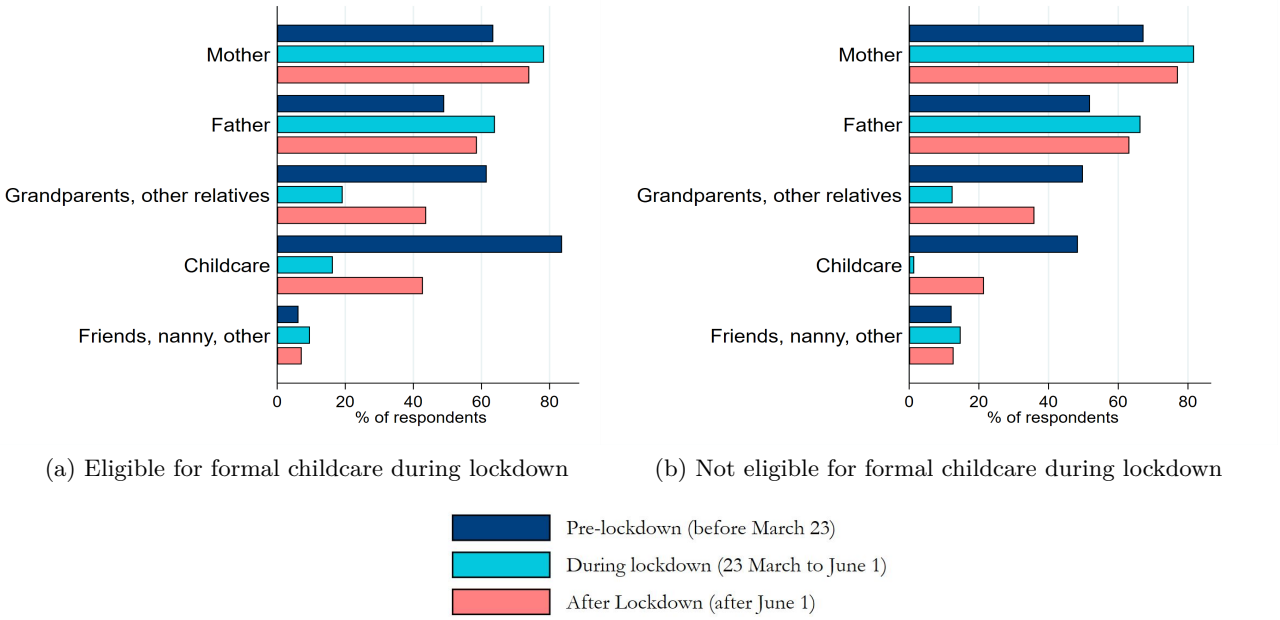
(a) Early years settings attendance in England over time



(b) Percentage of early years settings closed over time

Notes: Panel A shows the number of children attending early years settings over time. The statistic on children of critical workers was discontinued after the last week of August 2020. Panel B shows the proportion of early years settings reporting being closed or having unknown status. Source for both figures: Department for Education 'Attendance in education and early years settings during the coronavirus (COVID-19) outbreak'. https://explore-education-statistics.service.gov.uk/find-statistics/attendance-in-education-and-early-years-settings-during-the-coronavirus-covid-19-outbreak.

Figure A2: Type of childcare usage before, during and after lockdown, by eligibility

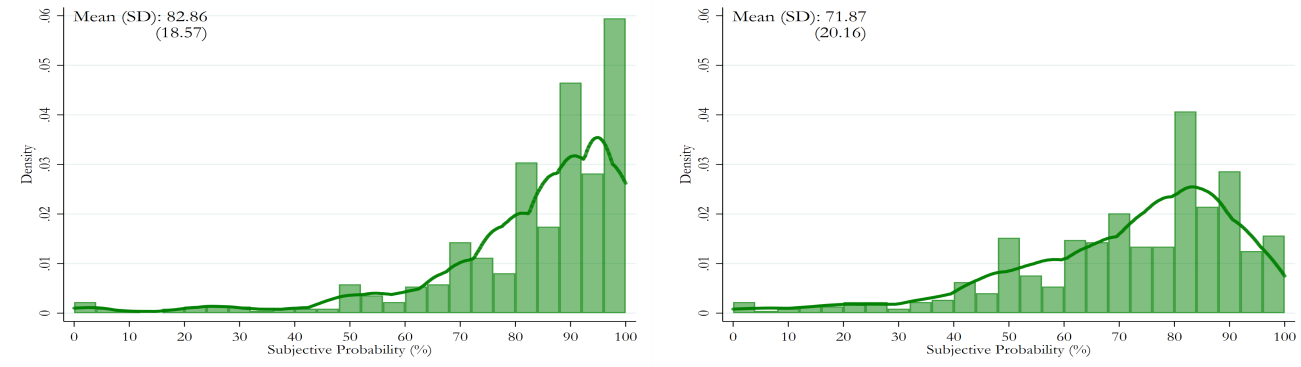


(a) Eligible for formal childcare during lockdown

(b) Not eligible for formal childcare during lockdown

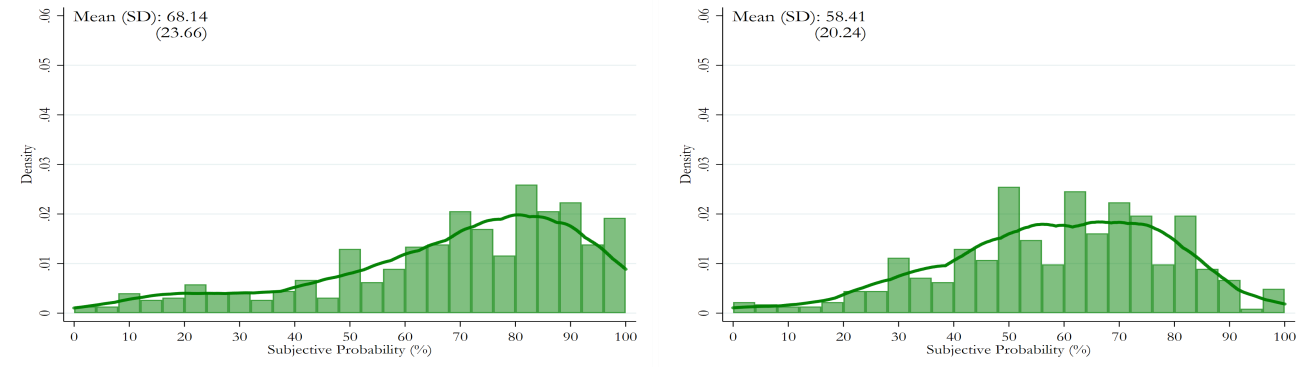
Notes: The Figure shows the types of childcare used by respondents at different points in time during the pandemic. Respondents were asked "Does your child currently use and did she/he previously use any of the following options? Please select all that apply" for the periods before lockdown, during lockdown and after lockdown (current). Dark blue is for before the first lockdown, light blue is for during the lockdown, and the final category is for after the restrictions were lifted (June 2020). The "Grandparents, other relatives" category includes non-resident parents. Childcare refers to nursery, preschool, creche, and childminder (i.e. formal childcare).

Figure A3: Distributions of perceived returns



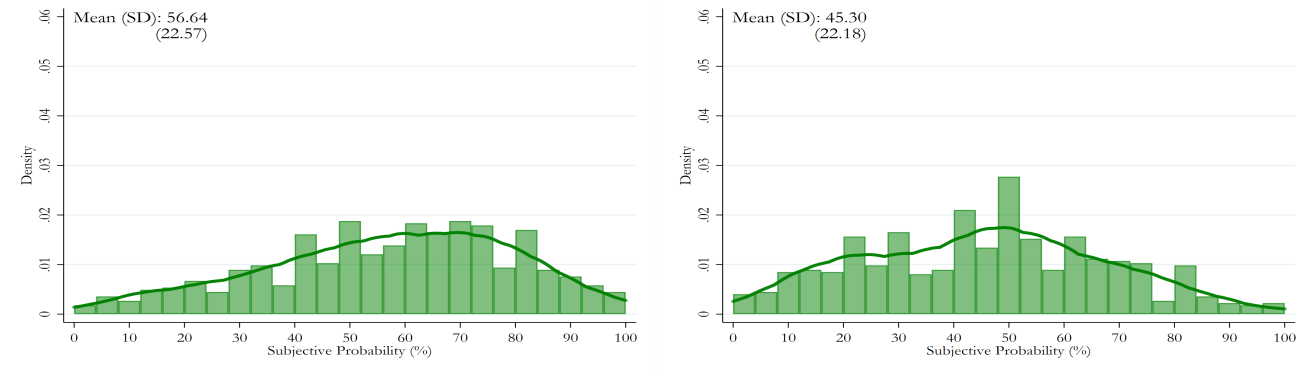
(a) A, F, F

(b) A, F, R



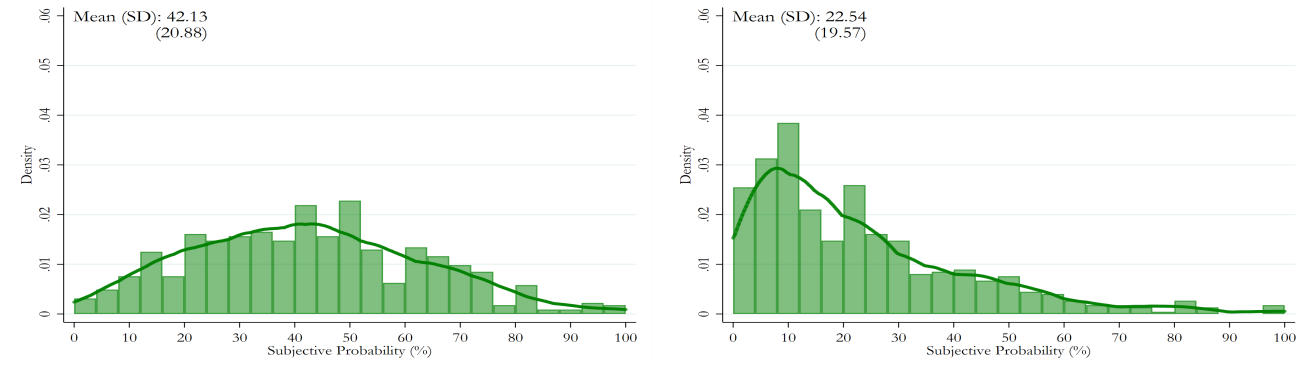
(c) N, F, F

(d) A, R, F



(e) N, F, R

(f) A, R, R

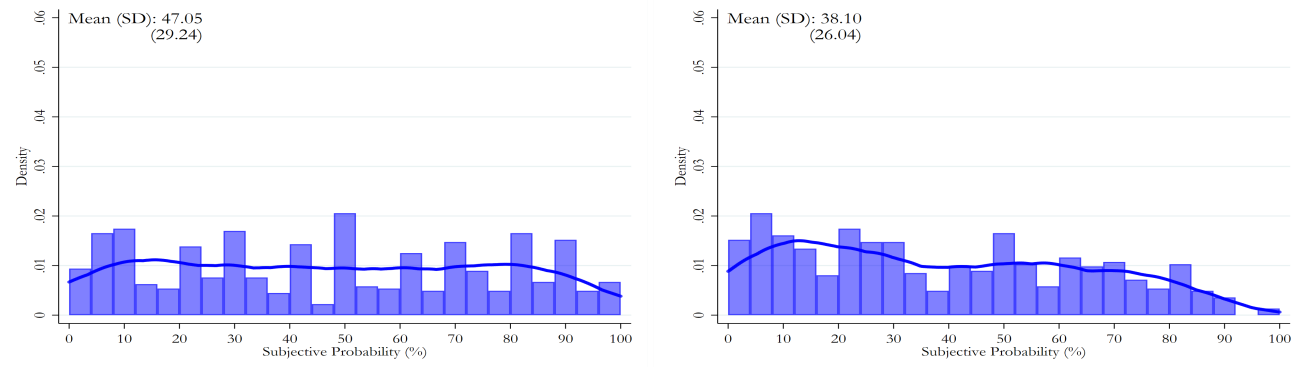


(g) N, R, F

(h) N, R, R

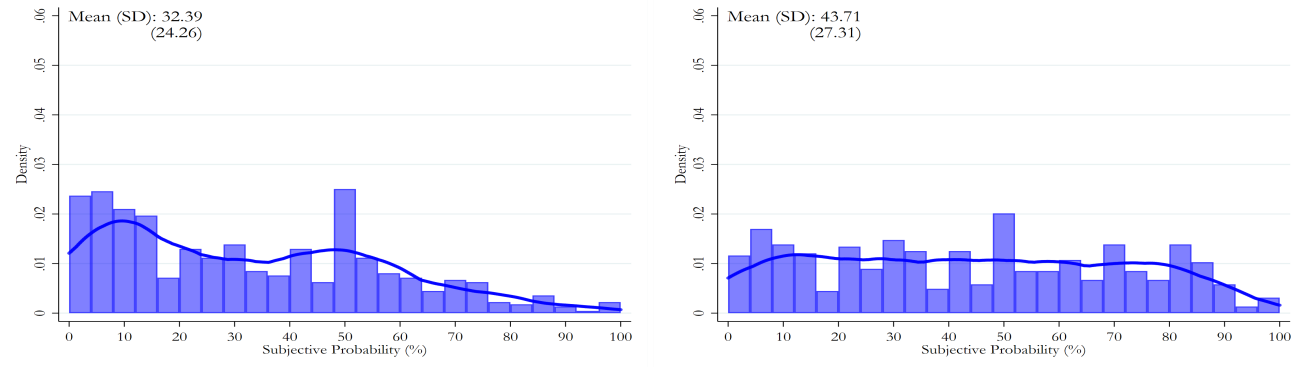
Notes: The Figure plots the histogram and the density for each scenario of the related proportion of children that respondents believe would reach a Good Level of Development by September 2020 (asked in July 2020). The scenarios are as in Table 2: attend formal childcare (Y/N); parental play with child (F/R); child play with friends (F/R). The first letter in each of the eight panels indicates childcare attendance, the second parental play, and the third play with friends.

Figure A4: Distributions of perceived risks



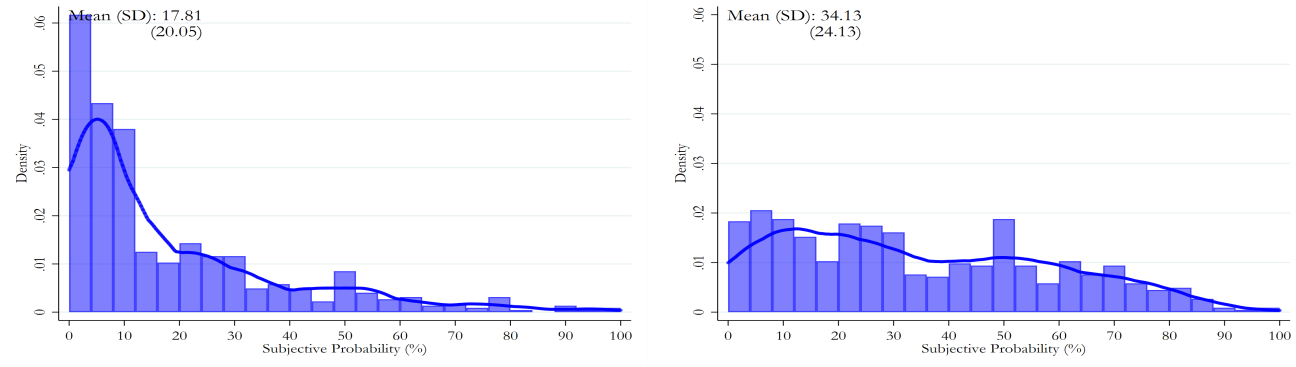
(a) A, F, F

(b) A, F, R



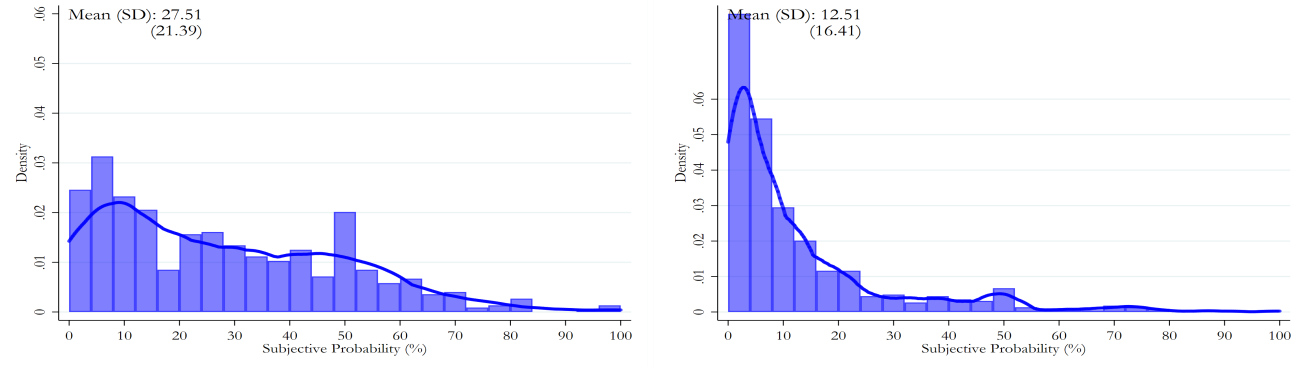
(c) N, F, F

(d) A, R, F



(e) N, F, R

(f) A, R, R



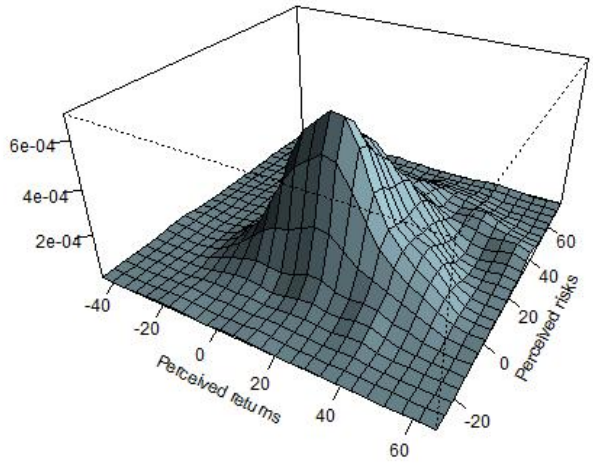
(g) N, R, F

(h) N, R, R

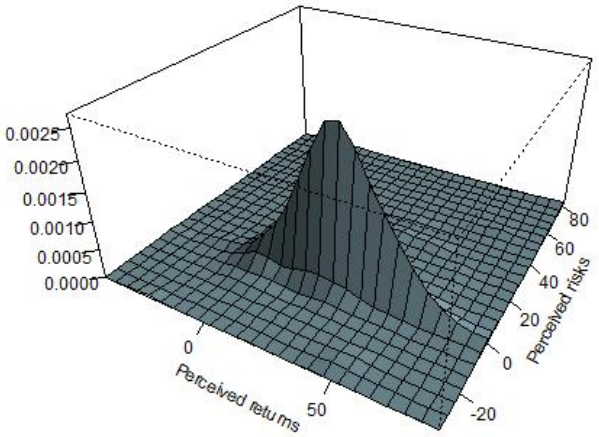
Notes: The Figure plots the histogram and the density for each scenario of the related proportion of children that respondents believe would contract and transmit COVID-19 by September 2020 (asked in July 2020). The scenarios are as in Table 2: attend formal childcare (Y/N); parental play with child (F/R); child play with friends (F/R). The first letter in each of the eight panels indicates childcare attendance, the second parental play, and the third play with friends.

Figure A5: Joint density plots of perceived returns and risks of the different investments

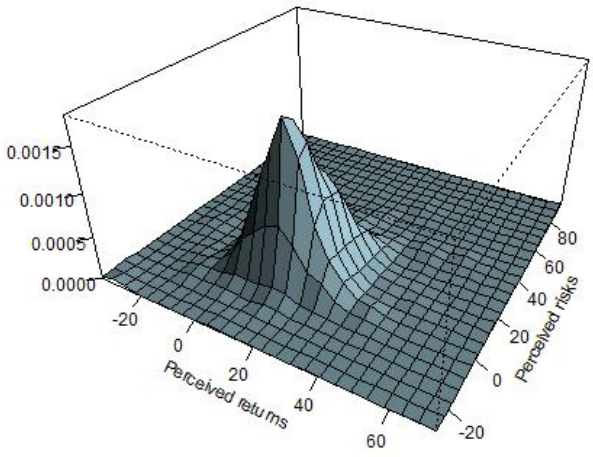
Formal childcare



Parental play

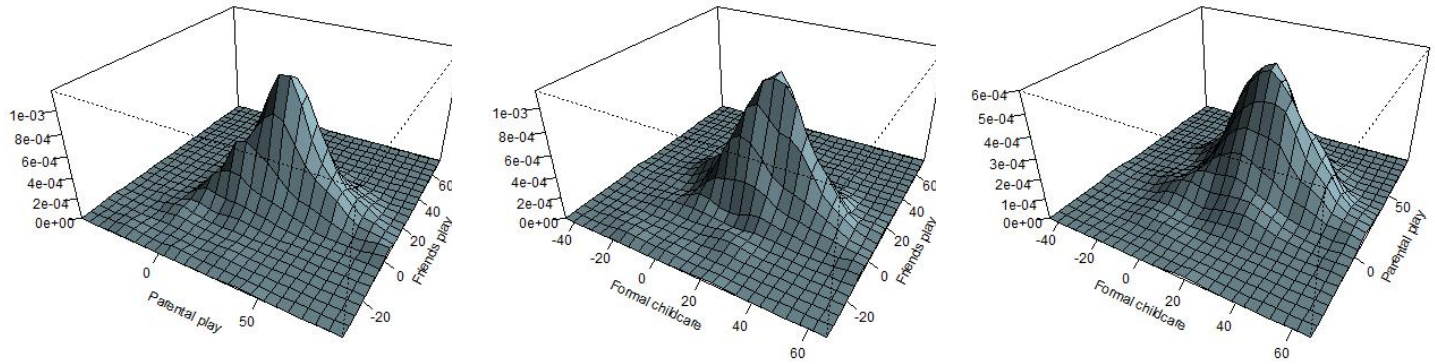


Friends play

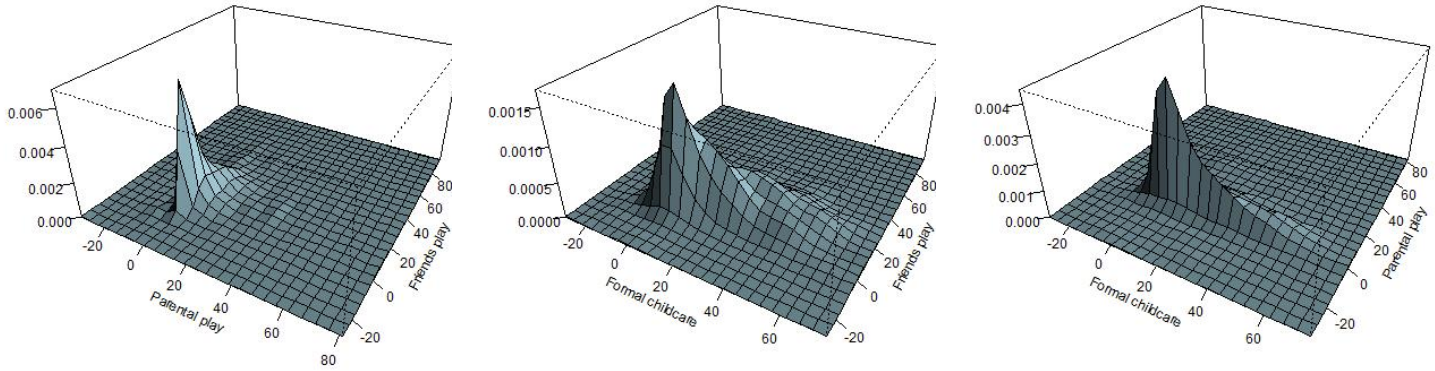


Notes: The figures plot separately for each type of investment the joint density of perceived returns and risks.

Figure A6: Joint density plots of different types of investment



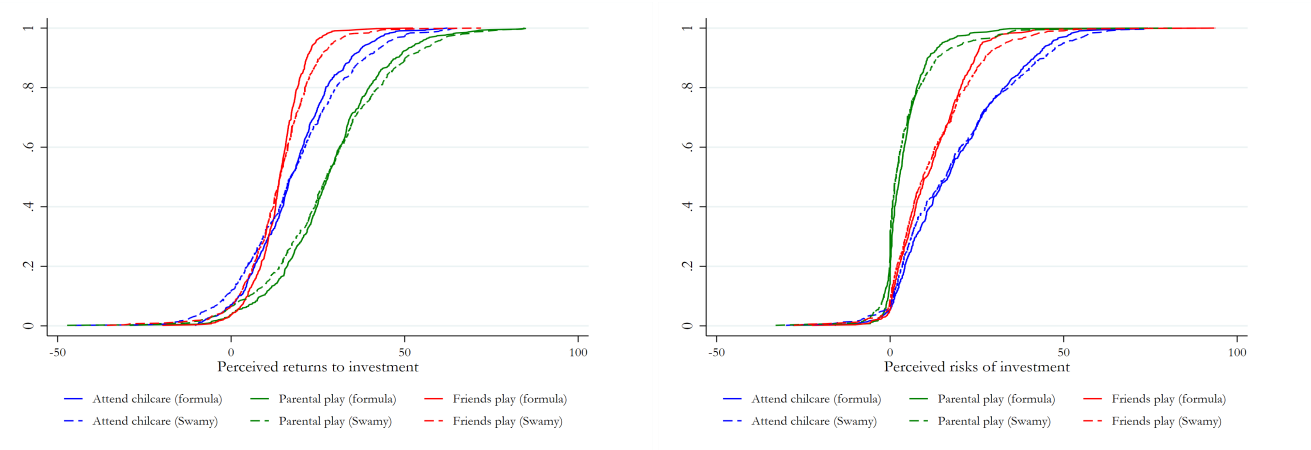
(a) Returns



(b) Risks

Notes: The figures plot the joint densities of individual perceived returns to and risks of investment. Each figure plots the joint distribution of two different pairs of returns (Panel A) or risks (Panel B).

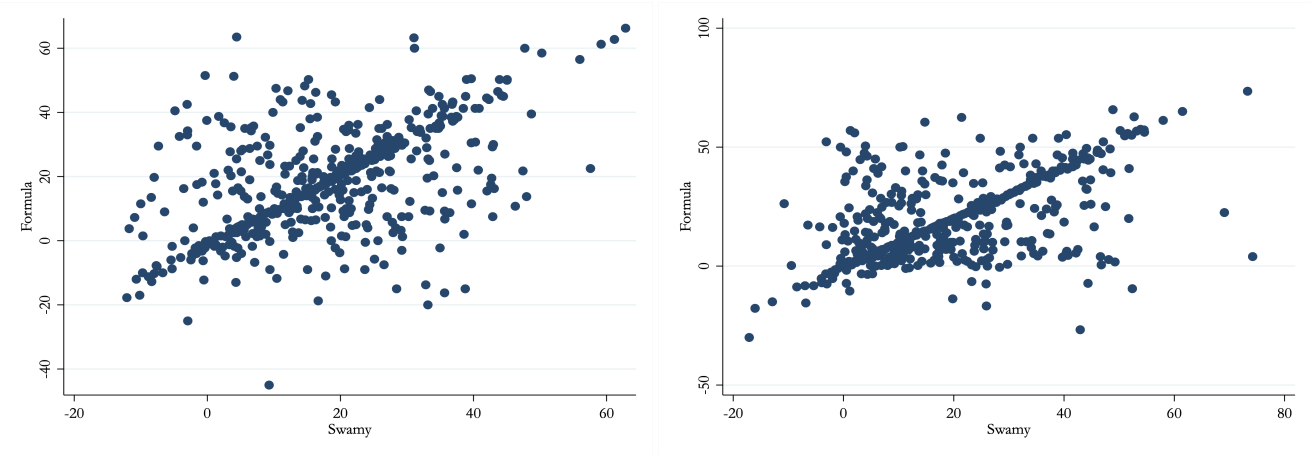
Figure A7: Cumulative distributions of individual beliefs (Swamy (1970) estimates vs formula (4))



(a) Returns (b) Risks

Notes: The Figure plots the cumulative distributions of individual perceived returns (Panel A) and risks (Panel B) estimated using the formula in (4) (solid line) and using the Swamy (1970) random coefficient model in equation (5) (dashed line).

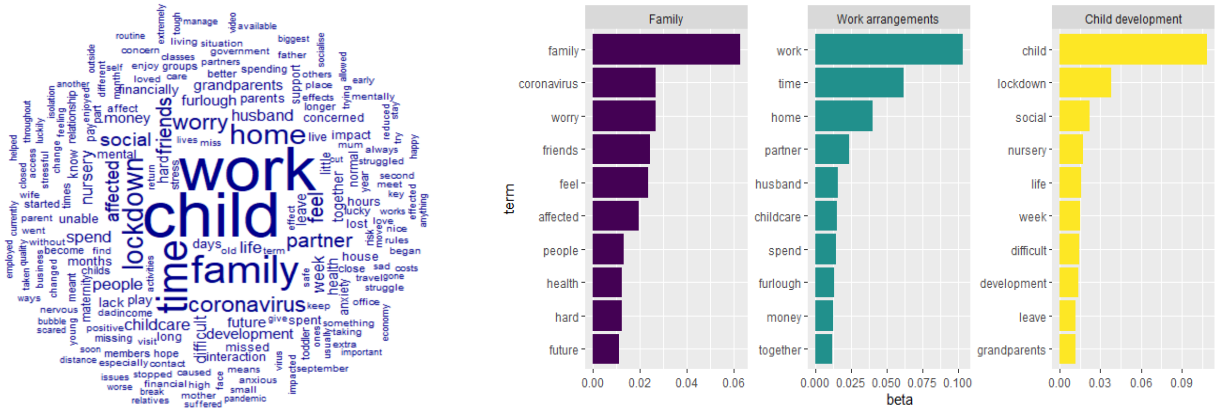
Figure A8: Scatter plot of individual beliefs related to formal childcare attendance (Swamy (1970) estimates vs formula (4))



(a) Returns (b) Risks

Notes: The Figure shows the scatter plot of perceived returns (Panel A) and risks (Panel B) to formal childcare attendance estimated using the formula in (4) (y-axis) and using the Swamy (1970) estimates of the random coefficient model in equation (5) (x-axis).

Figure A9: Text analysis of the open-ended question



(a) World Cloud (b) Latent Dirichlet Allocation

Notes: The Figure plots the world cloud (Panel A) and LDA model results (Panel B) from the text analysis of the answers to the following prompt: *"Please use the space below to express in your own words the main ways the Coronavirus outbreak has affected your life and/or your loved ones so far, and what you think the effects might be in the future. You can write as much or little as you like, and cover any topic you choose."*

B Appendix Tables

Table B1: Type of childcare use: before, during and after lockdown

	Mother	Father	Grandparents, relatives	Childcare	Friends, nanny, other
	(1)	(2)	(3)	(4)	(5)
During lockdown	14.748***	14.748***	-39.388***	-54.676***	2.878*
	(1.689)	(1.764)	(2.298)	(2.621)	(1.480)
Post-lockdown	10.252***	10.791***	-15.468***	-32.014***	0.719
	(1.562)	(1.586)	(1.979)	(2.502)	(1.299)
Observations	1668	1668	1668	1668	1668
Mean pre-lockdown (%)	65.827	50.719	54.317	61.871	9.892
R^2	0.020	0.016	0.114	0.185	0.002

Notes: The table presents the differences in childcare use during and after lockdown, as compared to before. Childcare refers to nursery, preschool, creche, and childminder (i.e. formal childcare). Standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table B2: Type of childcare use: pre-, during and post-lockdown, by eligibility

	Mother	Father	Grandparents, relatives	Childcare	Friends, nanny, other
	(1)	(2)	(3)	(4)	(5)
Pre-lockdown × Eligible for childcare	-3.785	-2.846	11.683***	35.248***	-5.924**
	(4.197)	(4.398)	(4.326)	(5.209)	(2.438)
During lockdown × Non-eligible for childcare	14.493***	14.493***	-37.391***	-46.957***	2.609
	(2.070)	(2.189)	(2.917)	(3.182)	(1.855)
During lockdown × Eligible for childcare	11.119***	12.058***	-30.624***	-32.060***	-2.559
	(3.822)	(4.291)	(3.845)	(4.113)	(2.704)
Post-lockdown × Non-eligible for childcare	9.855***	11.304***	-13.913***	-26.957***	0.580
	(1.898)	(1.940)	(2.588)	(2.905)	(1.694)
Post-lockdown × Eligible for childcare	6.792*	6.770	-6.105	-5.617	-4.962**
	(3.962)	(4.357)	(4.378)	(4.754)	(2.519)
Observations	1659	1659	1659	1659	1659
Mean pre-lockdown (%)	67.246	51.884	49.855	48.406	12.174
R^2	0.021	0.017	0.121	0.241	0.009

Notes: The table presents the differences in childcare use before, during and after lockdown. Childcare refers to nursery, preschool, creche, and childminder (i.e. formal childcare). Standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table B3: Descriptive statistics of time use variables

	N	Mean	Std. Dev.	Min	Max	p25	p75
Hours playing in April	556	5.79	3.07	0	18	4	8
Hours playing in July	557	5.37	2.85	0	14	3	7
Hours sleeping in April	556	7.61	1.95	0	18	6	9
Hours sleeping in July	557	7.12	1.79	1	13	6	8
Hours eating in April	556	3.76	1.62	0	14	3	5
Hours eating in July	556	3.67	1.48	0	11	3	5
Hours actively with mother in April	556	11.92	4.88	0	18	9	18
Hours actively with mother in July	557	11.18	4.76	0	18	8	15
Hours actively with father in April	556	6.08	5.35	0	18	2	9
Hours actively with father in July	557	5.50	4.72	0	18	2	8
Hours actively with another child in April	556	0.25	1.42	0	18	0	0
Hours actively with another child in July	557	0.57	2.00	0	14	0	0
Number of times taken to the playground in July	557	0.77	1.52	0	11	0	1

Notes: The table displays hours per day spent in the different activities in 2020, unless otherwise noted.

Table B4: Time-use diaries: hours per day spent in various activities pre- and post-lockdown

	Play	Sleep	Eat/Feed	Activity with mother	Activity with father	Activity with other child
	(1)	(2)	(3)	(4)	(5)	(6)
Post lockdown	-0.436***	-0.491***	-0.080	-0.729***	-0.588***	0.307***
(July 2020)	(0.110)	(0.065)	(0.064)	(0.159)	(0.188)	(0.084)
Constant	5.796***	7.614***	3.754***	11.916***	6.112***	0.259***
	(0.129)	(0.082)	(0.068)	(0.206)	(0.227)	(0.062)
Observations	1120	1120	1120	1120	1120	1120
R^2	0.005	0.017	0.001	0.006	0.003	0.008

Notes: The table presents the differences in activities (measured in hours per day) after lockdown (July 2020, the time of the data collection), as compared to during it (April 2020). Standard errors are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1.

Table B5: Correlations between perceived returns and risks

	Return: childcare	Return: play with parents	Return: play with friends	Risk: childcare	Risk: play with parents	Risk: play with friends
Return: childcare	1					
Return: play with parents	-0.0388	1				
Return: play with friends	-0.0202	0.322***	1			
Risk: childcare	0.139**	0.173***	0.102*	1		
Risk: play with parents	0.0296	0.111**	0.0739	0.158***	1	
Risk: play with friends	-0.0388	0.121**	0.317***	0.388***	0.218***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B6: Determinants of perceived returns and risks (additional controls)

	Panel A: Returns		
	Formal childcare	Parental play	Play with friends
	(1)	(2)	(3)
Respondent education: Further	1.251	7.511**	5.529**
	(3.095)	(3.503)	(2.219)
Respondent education: Higher	-1.301	10.841***	6.029***
	(2.935)	(3.285)	(2.127)
Respondent education: Postgraduate	-1.174	9.702***	4.378*
	(3.134)	(3.548)	(2.259)
Female respondent	-2.752	-1.255	1.843
	(1.775)	(1.959)	(1.124)
Key worker	0.964	-3.023*	-0.584
	(1.468)	(1.659)	(0.986)
Attended childcare pre-pandemic	6.644***	0.637	-0.387
	(1.437)	(1.643)	(0.973)
Gender of child (1=male, 0=female)	0.234	-3.569**	-0.763
	(1.353)	(1.555)	(0.888)
Child's age in years	0.705	-1.062	-0.772
	(0.749)	(0.928)	(0.517)
OFSTED quality	-2.504	-1.074	-3.467
	(12.843)	(12.848)	(7.237)
Respondent is white	-0.466	3.590	1.129
	(2.447)	(2.829)	(1.780)
Observations	554	554	554
Unconditional mean outcome	17.974	27.986	13.963
R^2	0.066	0.046	0.059
	Panel B: Risks		
	Formal childcare	Parental play	Play with friends
	(4)	(5)	(6)
Respondent education: Further	7.393**	2.169	3.316
	(2.935)	(1.703)	(2.503)
Respondent education: Higher	7.546***	1.729	3.539
	(2.742)	(1.585)	(2.403)
Respondent education: Postgraduate	5.365*	0.687	2.571
	(2.972)	(1.653)	(2.556)
Female respondent	2.739	-1.571	1.420
	(1.754)	(1.203)	(1.320)
Key worker	-1.642	1.859**	-0.255
	(1.627)	(0.893)	(1.167)
Attended childcare pre-pandemic	-3.131*	-0.615	-2.786**
	(1.681)	(0.882)	(1.204)
Gender of child (1=male, 0=female)	-0.030	0.539	-0.352
	(1.502)	(0.803)	(1.049)
Child's age in years	-0.147	0.367	0.326
	(0.843)	(0.485)	(0.577)
OFSTED quality	-18.605	1.242	-7.831
	(13.275)	(6.770)	(8.391)
Respondent is white	-1.158	-4.779**	-3.534
	(2.398)	(1.898)	(2.337)
Observations	552	552	552
Unconditional mean outcome	18.604	4.428	12.179
R^2	0.036	0.046	0.056

Notes: Each column displays results from a separate regression. The dependent variables are individual perceived returns (Panel A) and risks (Panel B) associated with each type of investment (indicated in the column header). Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B7: Determinants of perceived returns and risks with number of covid-19 cases and deaths

Panel A			**Returns**			
	Formal childcare		Parental play		Play with friends	
	(1)	(2)	(3)	(4)	(5)	(6)
Respondent education: Further education	1.141	1.223	7.619**	7.595**	5.662**	5.674**
	(3.039)	(3.062)	(3.547)	(3.542)	(2.203)	(2.205)
Respondent education: Higher	-1.390	-1.336	10.711***	10.756***	6.063***	6.106***
	(2.874)	(2.900)	(3.364)	(3.358)	(2.132)	(2.131)
Respondent education: Postgraduate	-1.347	-1.384	9.838***	9.868***	4.546**	4.552**
	(3.061)	(3.072)	(3.597)	(3.599)	(2.243)	(2.245)
Female respondent	-2.591	-2.423	-1.559	-1.533	1.699	1.767
	(1.775)	(1.770)	(1.952)	(1.966)	(1.130)	(1.150)
Key worker	0.877	0.905	-2.514	-2.546	-0.465	-0.475
	(1.443)	(1.434)	(1.637)	(1.647)	(0.986)	(0.989)
Attended childcare pre-pandemic	7.334***	7.321***	-0.983	-0.998	-1.141	-1.153
	(1.283)	(1.279)	(1.538)	(1.542)	(0.884)	(0.886)
Average covid-19 cases (previous 2 weeks)	0.019		-0.073		-0.036	
	(0.051)		(0.095)		(0.046)	
Average covid-19 deaths (previous 2 weeks)		-0.112		-0.043		-0.060
		(0.120)		(0.115)		(0.069)
Observations	554	554	554	554	554	554
Unconditional mean outcome	17.974	17.974	27.986	27.986	13.963	13.963
R^2	0.064	0.066	0.030	0.029	0.048	0.049
Panel B			**Risks**			
	Formal childcare		Parental play		Play with friends	
	(4)	(5)	(6)	(4)	(5)	(6)
Respondent education: Further education	7.567**	7.487**	2.226	2.137	3.370	3.338
	(2.953)	(2.947)	(1.703)	(1.686)	(2.505)	(2.506)
Respondent education: Higher	7.691***	7.639***	2.024	1.974	3.795	3.734
	(2.750)	(2.750)	(1.613)	(1.610)	(2.419)	(2.417)
Respondent education: Postgraduate	5.657*	5.676*	0.891	0.917	2.856	2.843
	(2.979)	(2.977)	(1.654)	(1.647)	(2.572)	(2.570)
Female respondent	2.682	2.552	-1.534	-1.671	1.419	1.326
	(1.757)	(1.756)	(1.184)	(1.187)	(1.328)	(1.345)
Key worker	-1.766	-1.797	1.628*	1.591*	-0.442	-0.446
	(1.608)	(1.605)	(0.883)	(0.884)	(1.150)	(1.147)
Attended childcare pre-pandemic	-3.406**	-3.391**	-0.224	-0.209	-2.566**	-2.548**
	(1.444)	(1.444)	(0.797)	(0.797)	(1.029)	(1.027)
Average covid-19 cases (previous 2 weeks)	-0.017		-0.028		0.037	
	(0.052)		(0.026)		(0.055)	
Average covid-19 deaths (previous 2 weeks)		0.101		0.102		0.092
		(0.138)		(0.083)		(0.111)
Observations	552	552	552	552	552	552
Unconditional mean outcome	18.604	18.604	4.428	4.428	12.179	12.179
R^2	0.028	0.029	0.019	0.023	0.048	0.049

Notes: Each column represents a separate regression. The dependent variable are individual perceived returns (Panel A) and risks (Panel B) associated with each type of investment (in column header). Covid-19 cases and deaths are at the local authority level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B8: Relationship between sentiment score and perceived returns and risks of investment

			Panel A: Returns			
	Formal childcare		Parental play		Play with friends	
	(1)	(2)	(3)	(4)	(5)	(6)
Second tercile of sentiment score	0.801	0.312	2.204	2.431	3.295**	3.366***
	(1.801)	(1.783)	(2.011)	(2.012)	(1.284)	(1.289)
Third tercile of sentiment score	0.448	-0.012	3.026*	2.627	1.993**	1.949**
	(1.608)	(1.579)	(1.764)	(1.754)	(0.983)	(0.986)
Observations	499	499	499	499	499	499
Unconditional mean outcome	18.115	18.115	29.195	29.195	14.655	14.655
Other controls	No	Yes	No	Yes	No	Yes
			Panel B: Risks			
	Formal childcare		Parental play		Play with friends	
	(1)	(2)	(3)	(4)	(5)	(6)
Second tercile of sentiment score	1.810	1.884	1.809*	1.715	1.734	1.794
	(1.986)	(1.990)	(1.077)	(1.066)	(1.499)	(1.501)
Third tercile of sentiment score	0.180	-0.096	0.344	0.115	0.577	0.717
	(1.716)	(1.709)	(0.927)	(0.941)	(1.157)	(1.163)
Observations	495	495	495	495	495	495
Unconditional mean outcome	18.101	18.101	29.194	29.194	14.575	14.575
Other controls	No	Yes	No	Yes	No	Yes

Notes: Each column presents results from a separate regression. The dependent variables are individual perceived returns (Panel A) and risks (Panel B) associated with each type of investment (attending formal childcare, parental play and play with friends) computed as in equation (4). The sentiment score is obtained by using the *syuzhet* lexicon applied to the answers to the following prompt: *"Please use the space below to express in your own words the main ways the Coronavirus outbreak has affected your life and/or your loved ones so far, and what you think the effects might be in the future. You can write as much or little as you like, and cover any topic you choose."* The sentiment score has been standardized to have mean 0 and standard deviation 1, and a higher value corresponds to more positive sentiments. Columns 2, 4 and 6 include the same set of controls as in Table 5: indicators for the respondent being female, indicator for being a key worker, education; an indicator for whether the child attended a formal childcare setting pre-pandemic. The sample size is reduced because not all respondents answered the open ended question. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B9: Parental beliefs and actual investments by child's age

	Formal childcare attendance	Play	Play-actively involved mother	Play-actively involved father	Playground use
	Panel A: Below 3 years old (child)				
	(1)	(2)	(3)	(4)	(5)
Return to childcare	0.007***	-0.015*	-0.020**	-0.017***	0.001
	(0.001)	(0.009)	(0.008)	(0.006)	(0.005)
Return to parental play	0.002*	0.017**	0.011	0.008	-0.004
	(0.001)	(0.008)	(0.007)	(0.006)	(0.004)
Return to play with friends	0.000	-0.034**	-0.030**	-0.014	0.012**
	(0.002)	(0.014)	(0.013)	(0.011)	(0.006)
Risk of childcare	-0.004***	0.001	0.014*	0.004	0.005
	(0.001)	(0.009)	(0.008)	(0.007)	(0.005)
Risk of parental play	-0.003*	-0.008	-0.021	-0.008	-0.007
	(0.002)	(0.015)	(0.014)	(0.011)	(0.005)
Risk of play with friends	-0.000	0.009	0.013	-0.002	-0.016***
	(0.001)	(0.014)	(0.011)	(0.009)	(0.005)
Respondent education: Further	0.085	0.166	-0.069	0.703*	0.273
	(0.069)	(0.548)	(0.566)	(0.417)	(0.281)
Respondent education: Higher	0.042	0.113	-0.271	0.679*	0.062
	(0.064)	(0.525)	(0.539)	(0.397)	(0.263)
Respondent education: Postgraduate	0.120*	-0.364	-0.910	0.734*	0.402
	(0.072)	(0.556)	(0.571)	(0.417)	(0.310)
Female respondent	0.008	-0.540	0.429	-1.663***	-0.187
	(0.047)	(0.342)	(0.317)	(0.298)	(0.161)
Key worker	0.082*	0.402	0.280	0.107	0.036
	(0.044)	(0.297)	(0.295)	(0.223)	(0.142)
Observations	442	442	442	442	442
Unconditional mean outcome	0.210	5.342	4.181	2.000	0.726
R^2	0.111	0.042	0.054	0.128	0.035
	Panel B: Above or equal 3 years old (child)				
	(1)	(2)	(3)	(4)	(5)
Return to childcare	0.005*	0.012	0.012	0.006	0.004
	(0.003)	(0.023)	(0.021)	(0.022)	(0.013)
Return to parental play	-0.001	0.010	0.018	0.023	0.004
	(0.003)	(0.019)	(0.017)	(0.014)	(0.010)
Return to play with friends	-0.001	-0.022	-0.014	-0.014	0.040**
	(0.005)	(0.038)	(0.035)	(0.031)	(0.019)
Risk of childcare	-0.005	-0.009	0.014	-0.004	-0.008
	(0.004)	(0.024)	(0.022)	(0.026)	(0.012)
Risk of parental play	0.008	-0.029	-0.010	0.001	0.019
	(0.005)	(0.022)	(0.022)	(0.018)	(0.015)
Risk of play with friends	0.005	0.036	0.014	-0.007	0.004
	(0.006)	(0.037)	(0.036)	(0.031)	(0.016)
Respondent education: Further	0.014	-1.296	-2.248*	0.325	0.236
	(0.170)	(1.209)	(1.183)	(0.688)	(0.391)
Respondent education: Higher	-0.009	-1.069	-1.615	0.252	0.366
	(0.143)	(1.177)	(1.139)	(0.573)	(0.352)
Respondent education: Postgraduate	0.083	-0.347	-1.667	0.517	1.673**
	(0.162)	(1.266)	(1.168)	(0.654)	(0.676)
Female respondent	0.036	-0.932	0.356	-2.055**	0.163
	(0.136)	(0.921)	(0.843)	(0.904)	(0.499)
Key worker	0.351***	0.670	0.061	1.244*	-0.030
	(0.109)	(0.733)	(0.556)	(0.642)	(0.342)
Observations	106	106	105	105	106
Unconditional mean outcome	0.368	5.321	3.524	1.876	0.991
R^2	0.172	0.053	0.077	0.180	0.175

Notes: The dependent variables are: an indicator variable for whether the child attends formal childcare in July 2020 (column 1), the number of hours the child spent playing in the July time use diary (column 2), the number of hours the respondent reported the mother spent actively playing with her child in the July time use diary (column 3), the number of hours the respondent reported the father spent actively playing with her child in the July time use diary (column 4), and the number of times the child was taken to the playground in a week in July 2020 (Column 5). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B10: Parental beliefs and actual investments by respondent's socio-economic status (SES) (education)

	Formal childcare attendance	Play	Play-actively involved mother	Play-actively involved father	Playground use
	Panel A: Low-SES respondents				
	(1)	(2)	(3)	(4)	(5)
Return to childcare	0.006***	-0.001	-0.011	-0.008	0.000
	(0.001)	(0.009)	(0.009)	(0.007)	(0.004)
Return to parental play	0.001	0.009	0.011	0.012*	-0.001
	(0.001)	(0.008)	(0.008)	(0.007)	(0.003)
Return to play with friends	-0.001	-0.030**	-0.026*	-0.022*	0.014**
	(0.002)	(0.015)	(0.015)	(0.012)	(0.007)
Risk of childcare	-0.003***	0.004	0.013	0.001	0.005
	(0.001)	(0.009)	(0.008)	(0.006)	(0.005)
Risk of parental play	-0.001	-0.001	-0.018	-0.002	0.003
	(0.002)	(0.013)	(0.013)	(0.010)	(0.006)
Risk of play with friends	-0.001	0.006	0.015	-0.004	-0.016***
	(0.002)	(0.014)	(0.013)	(0.009)	(0.006)
Female respondent	0.046	-0.525	0.717**	-1.632***	-0.208
	(0.047)	(0.362)	(0.329)	(0.310)	(0.167)
Key worker	0.133***	0.175	0.224	0.275	0.134
	(0.047)	(0.301)	(0.296)	(0.239)	(0.141)
Observations	422	422	421	421	422
Unconditional mean outcome	0.225	5.384	4.162	1.945	0.687
R^2	0.104	0.018	0.041	0.132	0.030
	Panel B: High-SES respondents				
	(1)	(2)	(3)	(4)	(5)
Return to childcare	0.010***	-0.041**	-0.041**	-0.034**	0.009
	(0.003)	(0.019)	(0.019)	(0.015)	(0.013)
Return to parental play	0.002	0.037***	0.015	0.007	-0.009
	(0.002)	(0.013)	(0.014)	(0.011)	(0.010)
Return to play with friends	-0.003	-0.041	-0.025	0.003	0.022
	(0.005)	(0.026)	(0.028)	(0.023)	(0.014)
Risk of childcare	-0.006**	0.006	0.022	0.015	0.010
	(0.003)	(0.023)	(0.019)	(0.020)	(0.014)
Risk of parental play	0.001	-0.032	-0.005	-0.033	-0.044***
	(0.005)	(0.032)	(0.033)	(0.028)	(0.014)
Risk of play with friends	0.001	0.003	0.002	-0.010	-0.018
	(0.003)	(0.035)	(0.026)	(0.029)	(0.013)
Female respondent	-0.002	-0.789	-0.407	-1.860***	-0.031
	(0.123)	(0.669)	(0.756)	(0.643)	(0.502)
Key worker	0.088	1.450**	0.306	0.501	-0.492
	(0.101)	(0.617)	(0.617)	(0.519)	(0.322)
Observations	116	116	116	116	116
Unconditional mean outcome	0.302	5.155	3.621	2.052	1.172
R^2	0.139	0.158	0.074	0.140	0.062

Notes: Panel A reports the estimates for high-SES respondents (defined by the respondent having above higher education). Panel B reports the estimates for low-SES respondents (defined by the respondent having below or equal to higher education). The dependent variables are: an indicator variable for whether the child attends formal childcare in July 2020 (column 1), the number of hours the child spent playing in the July time use diary (column 2), the number of hours the respondent reported the mother spent actively playing with her child in the July time use diary (column 3), the number of hours the respondent reported the father spent actively playing with her child in the July time use diary (column 4), and the number of times the child was taken to the playground in a week in July 2020 (Column 5). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.