

The impact of institutional childcare on non-cognitive skills of young children

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Abstract

Drawing on a rich nationally representative longitudinal sample of young children in Ireland, we present new evidence on whether the use of centre-based childcare in infancy promotes non-cognitive skills by school entry. Focusing on mothers who are working when their child is age nine months, and using methods based on matching on observational data, we find negative effects of the use of centre-based childcare compared to informal childcare by school entry. This effect is driven by lower educated mothers, boys, and by those using childcare more extensively. We conclude that the expansion of universal institutional, centre-based childcare could exacerbate educational inequalities.

JEL codes: I24, I28, J13.

Keywords: Centre-based childcare; non-cognitive skills; socio-emotional development; Growing Up in Ireland

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INTRODUCTION

The rapid expansion of early child education and care (ECEC) provision in many societies has stimulated analysis of the impact on both cognitive and non-cognitive development of the children using such care. ECEC has been argued to support the development of non-cognitive skills and to close the gap between more and less advantaged children in subsequent outcomes due to their influence on educational attainment and long-term gains (Carneiro and Heckman 2003). Yet the empirical evidence on the benefits of ECEC for development of non-cognitive skills is mixed (e.g. Felfe et al. 2015; Kuehnle and Oberfichtner 2020; Fort et al. 2020). Part of the reason for the mixed results is likely to derive both from different country contexts used in the studies and from methodological choices in relation to measures of non-cognitive skills, and the age at which exposure to ECEC is evaluated. In addition, findings are likely to differ as a result of the typical comparison of institutional, centre-based care with maternal care, given that non-working mothers are more or less selected in different contexts. We argue that it may be more relevant to compare *types* of non-parental childcare used by working mothers. The type of care may be relevant to children's development, given differences in opportunities for social interaction. Centre-based ECEC offers a more structured environment and higher exposure to social settings compared to informal care, but it also results in differences in individualised attention, with higher ratios of carers to children in informal care.

In this paper, we evaluate the impact of institutional childcare on non-cognitive skills of young children in Ireland. Our contributions are threefold. First, we focus on early childhood outcomes: a developmental phase which has been less studied in the literature on childcare effects but is known to be crucial for human capital development (Shonkoff 2010). We provide new evidence on the role of centre-based childcare in children's development of non-cognitive skills for a representative sample of Irish infants, whose mothers were in paid work when the child was aged nine months. Specifically, we evaluate the effect of centre-based childcare

compared to non-parental informal care in infancy (9 months) on the development of non-cognitive skills at school entry (5 years).

Second, our focus on mothers who are in paid work minimizes the issue of selection into childcare and means we avoid the issue of potential endogeneity between children's endowment of skills (which is unobservable to the researcher) and mothers' employment decision. We match on a rich suite of observables to compare similar households differing only in their choice of type of childcare. Ireland has seen a rapid increase in maternal employment; and the government has expanded support for centre-based ECEC – but not informal care – for pre-school children of working mothers. Our focus on working mothers therefore has direct policy relevance as well as expanding the knowledge base on ECEC.

Third, we investigate heterogeneous effects by maternal education to assess the topical and policy-relevant issue of whether ECEC contributes to reducing inequalities (Magnuson and Duncan 2016). We also evaluate effects by child sex, given potential differential sensitivity of boys and girls to centre-based ECEC (Baker et al. 2019).

We find that centre-based childcare has a negative effect on externalizing behaviour of an order of magnitude of 0.15-0.19 standard deviations. This effect is equivalent to half the gap in median externalizing behaviour between children with a mother with a degree compared to those with a mother with an upper secondary education. We further find that, when splitting the analysis between mothers with and without a degree, the negative effect of centre-based childcare is found only among mothers without a degree. When we investigate by child sex, we find the negative effect on externalizing and pro-social behaviour among boys only. We subject our results to a range of robustness checks. Our findings add to the growing literature that highlights the challenges in combining largescale expansion of universal childcare aimed at supporting mothers' labour supply with improving pre-school developmental outcomes, particularly among less-advantaged children.

The paper proceeds as follows. In the next section, we discuss the background to our study and the institutional context. Section 2 describes the data and the relevant descriptive statistics. Section 3 presents the methodology and Section 4 our main results, including on heterogeneous impacts and provides robustness checks. In Section 5 we offer some discussion and conclusions.

I BACKGROUND

The effect of childcare on children skills

The importance of the early development of non-cognitive skills for both enhancing cognitive development and reducing the attainment gaps between more and less advantaged children has been put forward in several studies by Heckman and others (e.g. Cunha and Heckman 2008; Carneiro and Heckman 2003). One route to achieving such gains is investment in formal, institutional ECEC (Carneiro and Heckman 2003). The extent to which formal, centre-based ECEC enhances *cognitive* skills has provided much positive, albeit some mixed evidence (e.g. Gregg et al. 2005; Del Boca et al. 2016, 2018; Di Caprera 2016; Felfe et al. 2015; Blanden et al. 2016; Kuehnle and Oberfichtner 2020; Fort et al. 2020). The gains in terms of *non-cognitive* skills have been explored in a more limited range of studies, which have found, positive (e.g. Datta Gupta and Simonsen 2010), but also zero (e.g. Hansen and Hawkes 2009; Kuehnle and Oberfichtner 2020) and negative (e.g. Magnuson et al. 2007; Baker et al. 2019) impacts of formal ECEC on children's non-cognitive skills. This leaves the benefits of institutional ECEC provision for reducing the gaps between more and less advantaged children an open question.

The observed discrepancies in findings may be partly driven by differences in country – and therefore institutional – context, indicating the need to add to the evidence from a wider range of countries. The ways in which non-cognitive skills and ECEC are measured also vary by study, and much of the literature focuses on children post-infancy (though see Drange and Havnes 2019). This draws attention to the need to build the evidence base paying particular

attention to early years, when children may be most susceptible to influences on their socio-emotional development (Shonkoff 2010; Magnuson and Duncan 2016).

Effects are also often estimated by comparison with parental, or specifically maternal care, rather than the alternative forms of childcare available to working mothers (e.g. Cornelissen et al. 2018; Baker et al. 2019). By investigating this topic among working mothers and by focusing on non-parental care, our analysis is not affected by the issue of endogeneity of the choice to participate in paid employment and children's non-cognitive skills, and thus offers a cleaner estimate of the effect of formal childcare. The issue of endogeneity in terms of *type* of childcare chosen is instead dealt with a matching approach on the observable characteristics of mother, child, and family. Our approach also speaks to pressing issues in terms of child-care expansion. Increasing mothers' labour supply is a widespread policy aim, typically supported by expansion of ECEC, rendering not *whether* but *how* that childcare is provided the salient policy question.

There is an ongoing debate as to whether ECEC potentially has equalising effects for more disadvantaged children (Carneiro and Heckman 2003). In studies of the impacts of institutional care on cognitive skills, the expectation is that these will have heterogeneous effects for more or less advantaged children. The intuition is that formal institutions have the potential to enhance children's learning and school-readiness, particularly where mothers' inputs may not provide such a level of educational stimulation, given that parental inputs are known to vary by educational background (Rowe 2008). A similar argument can be made in relation to non-cognitive skills. Formal settings might thus be expected to particularly benefit those children who come from less structured environments, which vary with maternal background (Lareau 2003). We therefore explore heterogeneity in effects by maternal education.

We focus on maternal education for several reasons. First, in our sample, mothers with tertiary education are more likely to enrol their child in centre-based childcare. Among working mothers with a degree using childcare when the baby is nine months old, about 63% use centre-based child-care. If variation in childcare use is one of the reasons for socially stratified variations in non-cognitive skills among school-children, differences in use across more- and less-educated mothers would reinforce the moves towards expansion of pre-school centre-based care. Second, the quality of the time spent with their children has been shown to differ across families with different levels of maternal education (Hart and Risley 1995). As a consequence, highly educated mothers who (choose to) spend more time with their young children have been found to be more likely to enhance their cognitive skills (Del Bono et al. 2016). Finally, the gap in the socio-emotional skills of children across low and highly educated mothers has actually increased between the 1970 and the 2000 birth cohorts in the UK (Attanasio et al., forthcoming). The UK is a country that is similar to Ireland, the country of our study, in terms of institutional settings and socio-cultural characteristics. We might expect a similar gap to prevail in Ireland, and hence it is critical to consider the potential differential effects of centre-based care.

We also differentiate our findings by child sex, since boys and girls are known to differ in their non-cognitive skills from the beginning of their school careers. In general, boys tend to struggle more than girls in terms of externalising and prosocial skills (e.g. Bertrand and Pan 2013). However, girls tend to have higher rates of anxiety, and might be expected to be more responsive to the environment to which they are exposed to at this stage of life (Font et al. 2020). This would imply that girls might be more affected by type of childcare. Nevertheless, several studies have pointed out that boys are more sensitive to inputs in childhood compared to girls (e.g. Weiss et al. 2002; Bertrand et al. 2013; Fan et al. 2015).

Institutional context

Our chosen setting provides an informative context in which to explore ECEC. Driven in part by interests in facilitating mothers' labour force participation (Nollenberger and Rodríguez-Planas 2015) and in part by a conviction of the benefits ECEC for children's development (Nores and Barnett 2010), institutional childcare has expanded rapidly in many industrialized countries over recent decades. Childcare in institutional settings – centre-based childcare – constitutes the primary vehicle of this expansion, though with substantial variation in costs for parents (OECD 2013). Ireland is no exception in these developments. Ireland has traditionally had a gendered division of paid work and family responsibility; but women's employment rates doubled between 1980 and 2010. Consistent with this major transformation of the labour market, the share of children under age 3 in formal childcare increased from under 10 per cent in 1995 to over 30 per cent by 2008 (OECD 2013). Between 2000 and 2010, grants to private and community providers of centre-based care accompanied a rapid expansion of these sectors. Nevertheless, costs remain among the highest in the OECD (Russell et al. 2018).

In Ireland, centre-based care is regulated by childcare legislation, which stipulates specific, age-dependent staff-child ratios. Up to age 1, the ratio is 1:3; from age 1 and up to age 2, it is 1:5; from age 2 and up to age 3, it is 1:6. From age 3 it increases to 1:8. This contrasts not only with one-to-one parental care, but also with childminders and other informal carers looking after children on their own or with few others. Note that the carer/child ratio of centre-based childcare after age 2 is higher than in many European countries, including those that have been the source of previous studies. We return to this point in our discussion.

At the time of our study, some subsidies were in place for low income parents accessing community-based care, but not for those using childminders (Russell et al. 2018). A more unified system with a more systematic parental subsidies was introduced in 2016, but this continues to focus on centre-based care rather than child-minders. Since child-minders are also

costly, low-income working parents may be incentivized to use community provided care, potentially limiting their choice (Russell et al. 2018). The extent to which centre-based care does or does not promote positive non-cognitive skills is thus germane, prompting the need for further evidence on its potentially heterogeneous effects.

II DATA AND DESCRIPTIVE ANALYSIS

Dataset and sample

We use the infant cohort of Growing Up in Ireland, a national longitudinal study of children and young people in Ireland (Williams et al. 2019). The study is a nationally representative probability sample covering the whole of Ireland, with 11,134 cohort members born in 2008 and first observed at 9 months old. Follow up surveys were carried out when the children were age 3, 5, 7 (postal survey only) and age 9. Interviews are carried out with the child's carers and information is also collected from the child and, following school entry, from teachers. We use the 9-month survey and the second follow up at age 5, when the children are entering school. We also use the age 3 survey in additional analysis. The survey contains rich information on the cohort children, their families, and on the type of childcare used. We keep only singleton children for whom the mother is the main carer respondent in the first three waves (N=8,178).

Given the selection issues introduced by labour force participation and childcare availability, and the potential endogeneity of labour force participation and children's socio-economic development, we retain in our sample only mothers who usually work and who were in paid work 9 months after the cohort child was born (N=4,913). In the context of increasing maternal employment (OECD 2016), the comparison between maternal care (provided by non-working mothers) and paid-for or formal care (e.g. Felfe et al. 2015) may not be the most appropriate comparison from a policy or estimation perspective. Highly educated mothers who

remain out of the labour market to care for their children will both tend to be highly selected and their choice may be endogenous to the skills of the child. For the same reason, we exclude those 1,100 cases where the *main* form of childcare is the mother or father. The treatment thus consists of having been exposed to institutional childcare as the main type of childcare arrangement at 9 months versus any other form of non-parental childcare. We note that in Ireland mothers' probability of return to work by nine months is impacted neither by perceived availability of formal childcare nor by the rural or urban location, which might be expected to have fewer childcare options (McGinnity, Murray and McNally 2013). Finally, we retain only those observations for which we have information about childcare and non-cognitive skills up to age 5. These restrictions leave us with a sample of 2,927 children with a mother in paid work at age nine months when they are first observed, whose main form of childcare is non-parental, and who are observed at the age 3 and age 5 follow-ups, when their non-cognitive skills are measured.

Mothers in our sample are, on average, more likely to have obtained a degree and their household is more affluent than the average household in the overall sample (see Appendix Table A1). This is consistent with them being in paid work. The percentage of mothers in our sample who are at the top and bottom quintile of the equivalised household annual income is 31.14% and 4.95%, respectively. It is thus important to highlight that our paper focuses on the more privileged section of the society.

Socio-emotional skills

As a measure of non-cognitive skills, we use the Strengths and Difficulties Questionnaire (SDQ) (Goodman 1997), a self-completion parental report on five domains of the child's emotional-behavioural development. Following the literature (Dickey and Blumberg 2004, Attanasio et al. forthcoming) we divide these skills into externalizing (conduct and peer), and

internalizing (hyperactivity and emotional). We reverse-code so that a higher score represents fewer problems – or better socio-emotional adjustment. We also provide the total score (the sum of all four domains) and use the pro-social scale, which might arguably be expected to be particularly sensitive to contexts with more rather than fewer other children (cf. Cappelen et al. 2020). The scores are standardized with mean equal to zero and standard deviation equal to one.

We focus on outcomes at 5 years old because this is when pupils start school, and thus when they all face similar circumstances in terms of interactions with peers, and when non-cognitive skills begin to be critical for their cognitive development. The SDQ is also an important determinant of later test scores (Aucejo and James, 2019).

We have argued that we might expect different consequences of type of childcare for children of higher- versus lower-educated mothers and for boys compared to girls. Given high levels of tertiary-educated in Ireland (CSO 2017), we distinguish mothers with a degree from those with an upper secondary education or less. Figures A1 and A2 in the appendix illustrate that the distribution of non-cognitive skills at age 5 differs by both maternal education and child sex, with children of higher educated mothers being in most cases skewed to the right (better outcomes), while boys fare worse for externalising and prosocial outcomes, and girls for internalising socio-emotional outcomes.

Type of childcare and its characteristics

About 28% of working mothers made use of centre-based childcare when their child was 9 months old. There is high persistence in type of childcare: three-quarters of these children remained in the same type of childcare at age 3. We consider childcare to be centre-based if it is a work-based creche (8.9%), nursery (86.5%), Montessori (2.4%), playschool, pre-school, and Naoinra (2.2%). All other non-institutional arrangements involve a relative or non-relative,

either in their home (17.3 and 12.6%, respectively) or in the child's home (36.6 and 33.5%, respectively). Thus, the main counter-factual that we use for identifying the effect of centre-based childcare is a non-parental adult in the child's home (70.1% of non-centre-based childcare). This will tend to be equivalent to a 1:1 adult/child ratio compared to the 1:3 to 1:8 ratio mandated in centre-based childcare. This is important to bear in mind when interpreting the results and comparing them with the existing literature. The ratios can be compared to those in studies that also cover childcare in infancy: the ratio of carer/pupils in centre-based childcare is 1:4 for Fort et al. (2016) and 1:3 for both Felfe and Lalive (2014) and Drange and Havnes (2020). The ratio of their counterfactuals is instead very likely to be 1:1, as children are most likely cared by parent, grandparent or nanny in Germany, Oslo, and Bologna respectively.

Table 1 shows the main characteristics of the type of childcare. There are larger numbers of children in informal care compared to centre-based, though note that here it is the numbers of children with the provider rather than the carer-to-child ratios which are being supplied. For the non-centre-based childcare arrangements the most common ratio is 1:1 (36%), though in a further 27% of cases it is 1:2. Those choosing informal care are more likely to cite quality of care as the main reason for their choice. Centre-based childcare is more expensive, but this is partly because it is used for more days and hours than other types of childcare. Correspondingly, financial constraints are not one of the most important determinants in making the choice.

[Table 1 here]

[Figure 1 here]

Turning to the relationship between childcare and socio-emotional skills, Figure 1 shows the non-standardized score of each measure of socio-emotional skills at age 5, as the children are entering formal schooling, by type of childcare. If anything, it appears that those who were in centre-based care have slightly worse outcomes (more skewed to the left) in terms

of external and pro-social behaviour but not on internalizing skills. When, however, we tested the equality of the two distributions, we failed to reject it at conventional statistically significant levels.

Clearly, though, these figures do not take into account that children and households with certain characteristics are more likely to choose institutional childcare. To estimate the effect of childcare on socio-emotional skills, we therefore need an approach that minimizes this selection issue.

III METHODOLOGY

Theoretical framework

We are interested in understanding the impact of being exposed to centre-based childcare in infancy (C_t) on socio-emotional skills at pre-scholar age (θ_{t+1}) among working mothers.

$$\theta_{t+1} = F(\theta_t, C_t, P_t, X_t)$$

Socio-emotional skills are a function of several other inputs, alongside type of childcare. These are the initial endowment of socio-emotional skills (θ_t), parental inputs (P_t) and individual characteristics (X_t), which all are determined before time $t+1$.

The argument for the impact of centre-based care on non-cognitive skills is similar to that for cognitive skills: in a more structured environment, children can learn important skills that will ease their transition to formal schooling and will increase their range of social skills through multiple interactions. At the same time, in infancy children interact much less with their peers, and more individualized attention from the carer may be more important (Fort, Ichino, and Zanella 2020). Hence the carer-child ratio in different settings might be salient for development.

Given that centre-based settings are characterized by a greater intensity and diversity of contact with other children, socio-emotional skills might plausibly respond differently to such settings compared to the more intimate – and less challenging – environment of informal or family-based childcare. Centre-based care would be expected to positively affect socio-emotional skills, particularly pro-social skills, as it facilitates regular social interaction with peers in a structured setting ($\frac{\partial \theta_{t+1}}{\partial c_t} > 0$). On the other hand, we might expect a negative effect, stemming from the relative lack of individualised attention, if that results in children having less input into how to regulate their behaviour ($\frac{\partial \theta_{t+1}}{\partial c_t} < 0$). Ultimately, which of these two forces prevails in affecting children socio-emotional skills is an empirical question.

Finally, as type of childcare is only one of the numerous inputs in the production function of non-cognitive skills, we expect that its effect on socio-emotional skills enhances or impairs that of other inputs, and so contributes to or undermines equalising opportunities. Our analysis will further shed light on the interaction between type of childcare with other inputs which are known to importantly impact the development of socio-emotional skills.

Empirical strategy

We carry out propensity score matching, drawing on a rich set of characteristics of mother, child, and household collected when the child was aged 9 months. The strength of the Growing Up in Ireland data is the rich range of information on several domains such as maternal and child health indicators and financial situation of the household. Table A1 in the Appendix reports all the variables that we use for building the propensity score (except for main reason of choice which is reported in Table 1). These include fixed characteristics (such as the birth weight and sex of the child and the ethnicity of the mother), and time-varying characteristics (such as the mother’s marital and status and household socio-economic status and earning quintile) which are measured when the child was aged nine months. These should not be

affected by the choice of type of childcare. We also condition on the health and the depression status of the mother, since the outcome of interest is based on the mother's responses, and her health status could bias how she classifies her child's behaviour (Kiernan and Huerta 2008). Finally, we also condition on the main reason for choosing that type of childcare. We implement Kernel matching with common support, and bootstrap standard errors with 100 replications.

The identification assumption relies on the selection on observables (the conditional independence assumption CIA), so that all relevant differences between treated ($D = 1$) and non-treated ($D = 0$) are captured in X , i.e. $E(Y_0|X, D = 1) = E(Y_0|X, D = 0)$. Given the relevant heterogeneity in childcare treatment highlighted in the literature across different groups of the population (Cornelissen et al. 2018, Felfe and Lalive 2018), we estimate the average treatment effect, as well as the average treatment effect on the treated and on the untreated, ATE, ATT, and ATU, respectively.

In Figure 2 we report the estimated density of the predicted probabilities that a child in non-centre-based childcare is in centre-based childcare (untreated) and that a child in centre-based childcare is in a centre-based childcare (treated), i.e. the propensity score $p(x) \approx Pr(D = 1|X = x)$. There is very good common support: the probability mass is not too close to 0 or 1 and the two estimated densities overlap each other where they have most of their respective masses (Busso et al. 2014). This makes us confident that the overlap assumption is not violated and so we can safely identify the ATE, ATT and ATU, by conditioning on X , which requires that $0 < p(x) < 1, \forall x$. After matching, the two densities mechanically fully overlap. Figure 3 illustrates the reduction of the bias once the sample is matched on the propensity score: for a detailed illustration of how the mean values of the unmatched sample differ by each covariate refer to Table A1. The right-hand panel of Figure 2 shows two balance measures of each covariate before and after propensity score matching. This provides

additional support for a strong balance of each observable characteristic after matching. Indeed, before matching households selecting into different type of childcare differ in several observable characteristics. Most notably, as shown by the mean difference, households using centre-based childcare are less likely to put quality of care provided as the main reason for their choice (as already seen in Table 1); they are also more likely to have an older mother, with a tertiary education, and to be in the highest earning quintiles and social class (as shown in Table A1).

Given that more advantaged households choose centre-based childcare, we would expect that if there are any unobservable characteristics confounding our estimates, these should downward bias our results. Thus, we can interpret our results as lower-bound estimates of the effect of institutional childcare on socio-emotional skills.

[Figures 2 and 3 here]

IV RESULTS

Table 2 shows the ATE, ATT, and ATU for each outcome. Attending centre-based childcare negatively affects the development of externalizing and pro-social skills. The negative effect on total skills is driven by the externalizing component. It is statistically significant at 1% level and ranges between 0.15-0.19 standard deviations, depending on the average effect considered. These effects are not negligible as they are equivalent to half the gap in median externalizing behaviour for those children in the top social class versus those in the second highest social class. They also equate to half of the gap in median externalizing behaviour between children with a mother with a degree versus those with a mother with an upper secondary education. It is worth noting that the magnitude is similar to that found in other contexts for cognitive skills, even if it goes in the opposite direction. For example, Drange and Havnes (2019) find that infant in public childcare perform better on language and mathematics tests by 0.16 and 0.11

standard deviations, respectively. In their setting, this was equivalent to about the gap between children from high- low-income families and to half the gap between children from high- and low-educated parents.

Indeed, when comparing the effect sizes of ATE, ATU and ATT, we see that larger effects are found among those untreated, followed by the average effect and the effect on the treated ($ATU > ATE > ATT$). This is comparable to the pattern of effects found in Cornelissen et al. (2018). Despite the fact that the differences between the ATU, ATE and ATT are not always statistically significant, the magnitude of the effects suggests that there is heterogeneity in the returns to centre-based childcare, such that those that do not select into it are those that would be more affected. However, by contrast with Cornelissen et al (2018) in our study, the consequences of selecting into centre-based care are negative. This means that those who prefer to use more informal care benefit from rather than losing out from that choice. This suggests that parental choice is a relevant consideration in developmentally supportive childcare, an issue we return to in the discussion.

[Table 2 here]

Our findings suggest that instead of promoting non-cognitive skills in a social context, early contact with other children in a more formal context does either has neutral effects or is not beneficial for children's behaviour when they start school. Indeed, it results in poorer externalizing behaviours. This is consistent with the literature suggesting that children gain more benefit from informal family-based inputs (e.g. Baker et al. 2019), though contrasts with evidence on the pro-social benefits of formal programmes (Cappelen et al. 2020). Our findings are distinctive, however. We compare formal care with informal non-parental care, which is sometimes assumed to be of lower quality, partly because providers are less likely to be trained or regulated, rather than with parental care, where effects can be seen to be driven by parents' direct investment in the children (e.g. Felfe et al. 2015).

Given this, our findings might seem somewhat counter-intuitive. A feature of centre-based childcare is that it exposes children from a young age to a rich social environment. However, at infancy other inputs, such as attachment (Bowlby 1969) which could be developed in the more intimate environment of most forms of non-institutional care, may take precedence in aiding development of a range of skills, including social skills, among young children. Supporting this argument, in the counterfactual of informal care, used for estimating the effect of centre-based childcare the adult-child ratios tends to be 1:1 or 1:2. This is the case for 63% of non-institutional childcare in our sample. By contrast, as described above, the regulated ratios for centre-based childcare is 1:3 for children under 1 to 1:6 for children up to 3 years old and rise to 1:8 above that age.

The adult/children ratio in Ireland in pre-school childcare is higher relative to that one in other countries such as Norway and Germany, but closer or equal to that one in Italy and Quebec (see Fort, et al. 2020). In this context, it is notable that our findings goes in the same direction as Font et al. (2020) and Baker et al. (2019), which are based in Italy and Quebec respectively, and contrast with those of Cornelissen et al. (2018), Felfe and Lalive (2018) and of Drange and Havnes (2018), which are based in Germany and Norway.

To shed further light on whether the adult-child ratio in institutional compared to informal care might be contributing to our findings, we build on the fact that in Ireland the adult/children ratio increases from age 3 (up to 1:8). We therefore investigate whether we observe different outcomes at age 3, where childcare impacts are prior to or concurrent with the increase in the ratio, compared to those at age 5, when the care groups in centre-based care have expanded, while informal care remains individualised. To be precise, when mothers are asked in the age 3 questionnaire how many children are looked after in the same room as their child, they report that 74% of children in non-centre based care share the same room with 0 to other 2 children, i.e. the adult/child ratio is 1:1 (33%), 1:2 (24%) and 1:3 (17%) assuming that

there is only one adult in the same room. For children in centre-based childcare, we see that at age 3 there is a substantial increase, in line with the regulations, in the adult-child ratios, compared to the ratios illustrated in Table 1. In centre-based care, the percentage of children sharing the same room with other 0 to 2 children is only 1%. Instead, from this age, 76% share a room with at least other seven children. While the number of children in the room is not a direct reflection of adult-child ratios, for a subset of those in centre-based care we were able to construct a variable showing the ratio of adult(s)/children (Figure A3). This makes it clear that the large majority of children in informal care are looked after by one adult per one or two children, while the ratios are much higher for children in centre-based care.

Table 3 shows that estimates for age 3 indicate no effect of the type of care on externalising behaviours, and a positive impact of centre-based care on pro-social behaviours. This therefore provides indicative evidence that the negative effect on externalising behaviours could be driven by a decrease in the attention paid to the child as the adult-children ratio increases from age 3. We cannot, however, disentangle the effect of age from that of the increase in the staffing ratio. It might be that institutional care offers a good option for young children, but less so for pre-school children, which is where the expansion in provision has been greatest (and least targeted). These positive impacts at age 3 are further reinforced by maternal reports relating to their positive experience of centre-based childcare collected from a subset of mothers (Figure A4).

[Table 3 here]

Heterogeneity

While these findings raise questions about the role of centre-based childcare in delivering gains in non-cognitive skills in the average child, of key interest is whether they are consistent across different socio-economic and demographic groups. For example, if they only apply to higher educated mothers, then we could interpret centre-based childcare as having a somewhat

equalizing effect (cf. Cornelissen et al. 2018). We therefore split the sample between mothers with and without a degree, one of the main characteristics affecting the likelihood of choosing centre-based childcare. Table 4 shows that it is, rather, among lower educated mothers that we observe the negative effects of centre-based care. While, we cannot dismiss the possibility (at the 5% level) that the effect is the same for high and low-educated mothers, it is only among the latter-subsample that it is significantly negative. Rather than working to equalize children's non-cognitive skill development as they enter formal schooling, centre-based care would therefore appear to have the opposite effect (consistent with the finding that $ATU > ATE > ATT$ in the analysis on the pooled sample). Interestingly, centre-based childcare positively affects internalizing behaviour among children with lower-educated mothers, however this effect is not precisely estimated.

This finding suggests that the potential negative impact on skill development among children attending centre-based childcare may be balanced among those with high-educated mothers by maternal investment at home, where the quality of latter is a function of the education of the mother (Del Bono et al. 2016), but that this compensatory effect is not so available to children lower educated mothers. When we investigate heterogeneity using measures capturing household social class, we do not find any statistically significant differences for the different sub-populations. This may indicate that the result found on mother education is not a matter of financial resources but more of the quality of mothers' interactions with their children (cf. Attanasio et al. 2020). The results again suggest that the effect of institutional childcare for children of lower-educated mothers, is greater among those less likely to select into it. Since the effect is negative- those lower-educated mothers making alternative arrangements would appear to have their choices vindicated in relation to the impact on non-cognitive skills. This makes the subsidies available to low-income families for centre-

based, but not informal care, a salient policy issue, where the implications go beyond simply parental choice (cf. Russell et al. 2018).

[Table 4 here]

Finally, we investigate heterogeneity by child gender. In our data boys on average experience worse external and pro-social skills than girls, while the opposite is true for internalizing scores (Table A2 in the Appendix). The mean values for internal, external, and pro-social scores are, respectively: -0.018, 0.162, and 0.136 for girls. For boys, they are: 0.017, -0.148, and -0.125, respectively. Given that the previous results point to a negative effect on externalizing and pro-social skills, where boys struggle the most, we could infer that boys are the children who, at the margins, are most affected by type of childcare. We indeed find that this is the case, see Table 5. The effects for girls and boys are, moreover, statistically significantly different from each other.

[Table 5 here]

Tables A2 and A3 show that the findings for heterogeneous impacts are largely replicated at age 3: in that children of women with no degree and boys are those more affected by exposure to different types of childcare. For these younger children, though it is the positive effects of centre-based care on pro-social behaviour which are experienced by children of lower-educated mothers and boys.

Robustness checks

We implement several robustness checks. First, the SDQ is answered by mothers. We thus used as an alternative the teacher report, with consistent results (Table A4). When using the teacher report, the negative effect on pro-social behaviour is also statistically significant. We adduce that this could be driven by teachers being more likely to observe more occasions of social interactions in the classroom compared to the mother.

Second, if what we find is truly an effect of the type of childcare, it should be observed more among high users than among lower users of childcare. This is indeed what we find when splitting the sample by the extent of use of childcare (Table A5).

Third, in our main analysis, we used childcare at age 9 months because it is less likely at this age that parental choice of childcare will be influenced by the non-cognitive traits of their child. Nevertheless, when we replicate the analysis using type of childcare at age 3 for age 5 outcomes, the results for the negative effects on externalizing behaviour are unchanged (Table A6). This is consistent with our findings reported in Table 5 indicating the negative effect is not present by age 3. When using age 3 childcare we also observed a statistically significant negative effect on pro-social behaviour.

We additionally instrumented childcare at age 3 with childcare at nine months, and again found consistent results (Table A7), although these IV estimates represent a local average treatment effect. That is, the effect is observed for those who have been treated at age 3 because they were in centre-based childcare at 9 months.

Fourth, to show that our results are not driven by the empirical method chosen, we replicate the analysis using inverse probability weighting. The main findings hold, see Table A8. Finally, for checking the external validity of our findings, we replicated the analysis using the Millennium Cohort Study (MCS), a cohort study for the UK (Table A8), with a similar design to Growing Up in Ireland. The children in the MCS sample were entitled to free part-time nursery education at age 4, leading many of them to enter centre-based care at, or prior to that age. At 9 months about 13% of children in the UK were in centre-based care and, as in Ireland, formal childcare is the preferred form of childcare for better off households (see Del Boca et al. 2018 for more details). The results on externalizing socio-emotional outcomes correspond to those in Ireland, though we also find a positive and statistically significant effect on internalizing scores.

V DISCUSSION AND CONCLUSION

Bowles and Gintis (1976) asserted the importance of non-cognitive skills for schooling and employment outcomes, and subsequent research has attested to their relevance for a range of adult outcomes (Farkas 2003; Heckman, Stixrud and Urzua 2006). Non-cognitive skills themselves are variously defined across the literature (Gutman and Schoon 2013), but encompass a range of orientations and behaviours that both facilitate learning – and hence the development of cognitive skills – such as attention and motivation, but which also provide qualities valued by employers, such as social skills, loyalty and perseverance.

The development of non-cognitive skills in early life is important for children’s educational and later life outcomes. Yet, inequalities in these skills continue to hamper equality of outcomes (Farkas 2003). The role of ECEC in promoting both cognitive and non-cognitive skills, and for reducing the family background gap has been much discussed (e.g. Cunha and Heckman 2008; Carneiro and Heckman 2003). Yet, evidence on its potential is equivocal at best and little evidence is present for early outcomes.

Using a nationally representative cohort study of Irish infants, we present new evidence on the role of institutional centre-based childcare in impacting the development of non-cognitive skills by school entry. We focused on the children of working mothers, as we compare the effects of institutional childcare with the more salient counterfactual for such mothers of informal, non-parental care, rather than maternal care. We argued that the formal setting and the potential for greater interaction might aid the development of pro-social and non-cognitive skills in centre-based care, in line with studies that have found positive effects. Conversely, we suggested that, the fact that formal childcare settings tend to have larger numbers of children, with less one-to-one attention, might inhibit the development of non-cognitive and pro-social skills relative to more informal but more individualized settings. This

would be consistent with studies finding a negative impact of institutional care. We find that by the time of school entry, far from promoting the development of non-cognitive skills through more intensive interaction with other children, centre-based childcare has a negative impact on externalizing problems. We thus demonstrate lack of clear positive effects of formal, centre-based ECEC not only in targeted settings (see discussion in Cornelissen et al. 2018 and Drange and Havnes 20219) but also in universal programmes. These effects only emerged in the period after age 3, when adult-child ratios in centre-based care increase, while informal care remains individualised. Indeed, positive prosocial effects of centre-based care were found at age 3 but were not sustained into school entry. The first year in school is a critical time for children, when non-cognitive skills have the ability to enable children to adapt to the classroom environment effectively. Therefore, our findings, which are robust to a series of alternative specifications, raise concerns about the role of centre-based ECEC in supporting children's transition to school.

We also show that the negative effect of centre-based ECEC is driven by the impact on children of mothers with less than tertiary education, and impacts boys rather than girls. Our findings add to the growing literature that fails to demonstrate clear compensatory effects of ECEC; but contrasts with studies, such as Felfe and Lalive (2016), that find a positive effect at this stage of socio-emotional development.

The implication is that as institutional childcare expands in countries such as Ireland to meet changing patterns of maternal labour supply, it may introduce costs for children's initial adjustment to the classroom. The expansion of centre-based provision is particularly focused on the years directly prior to school entry. Our findings suggest that (lower educated) mothers who choose to use alternatives to centre-based care are making choices that have benefits for their children's socio-emotional development, even if low-income mothers could be incentivised to do otherwise, through subsidised places in institutional provision. This might

imply that incorporating child-minders into regulatory frameworks in Ireland may enhance not just parental choice (cf. Russell et al. 2018), but also children's non-cognitive development. We encourage further research on the impact of institutional childcare on skills development in infancy in other contexts to gain a more comprehensive understanding of the factors that determine the direction and magnitude of its effects on the average child and on the socio-economic and gender gap in educational achievement.

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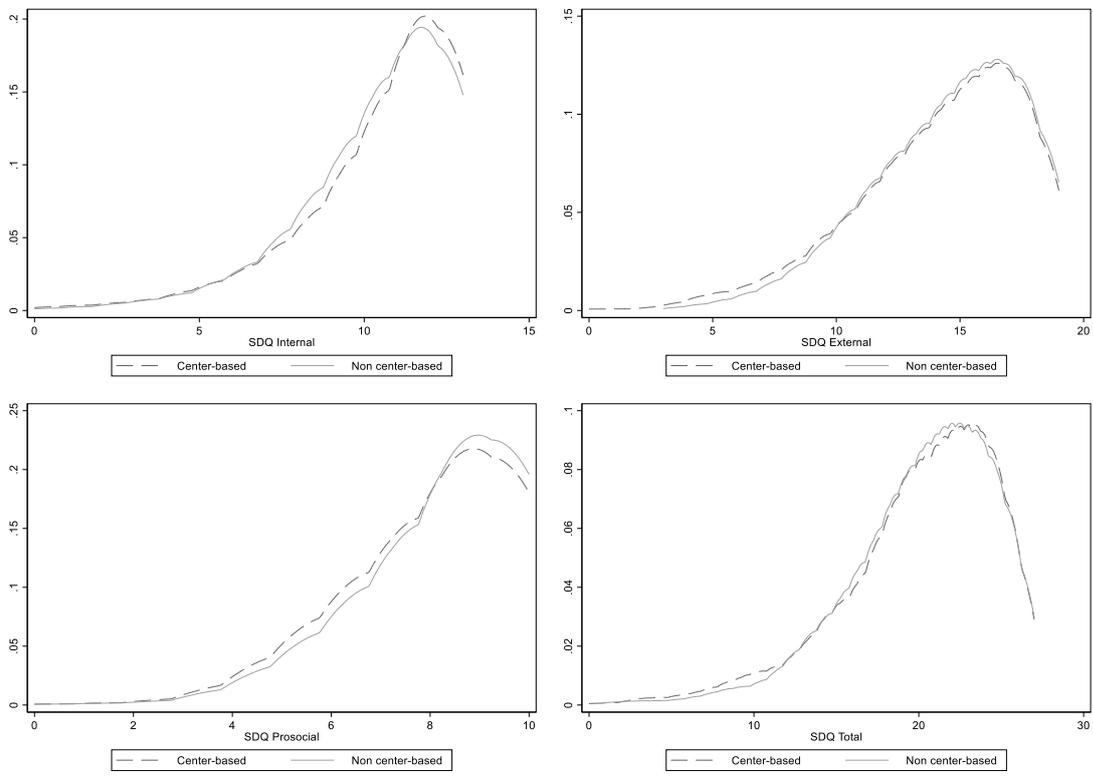
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FIGURES AND TABLES

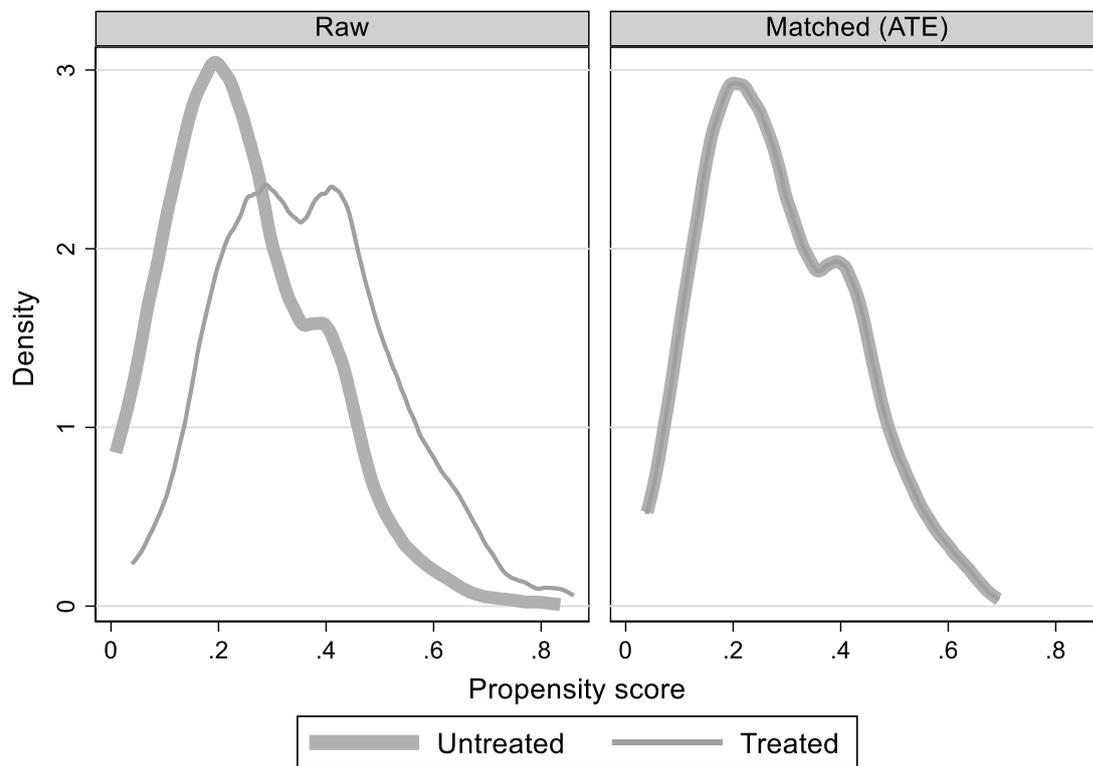
Figure 1: Socio-emotional skills: internalizing, externalizing, pro-social and total outcomes at age 5, by type of childcare at nine months



Source: Growing up in Ireland, waves 1 - 3.

Note: childcare type measured at age nine months and socio-emotional skills measured at age 5.

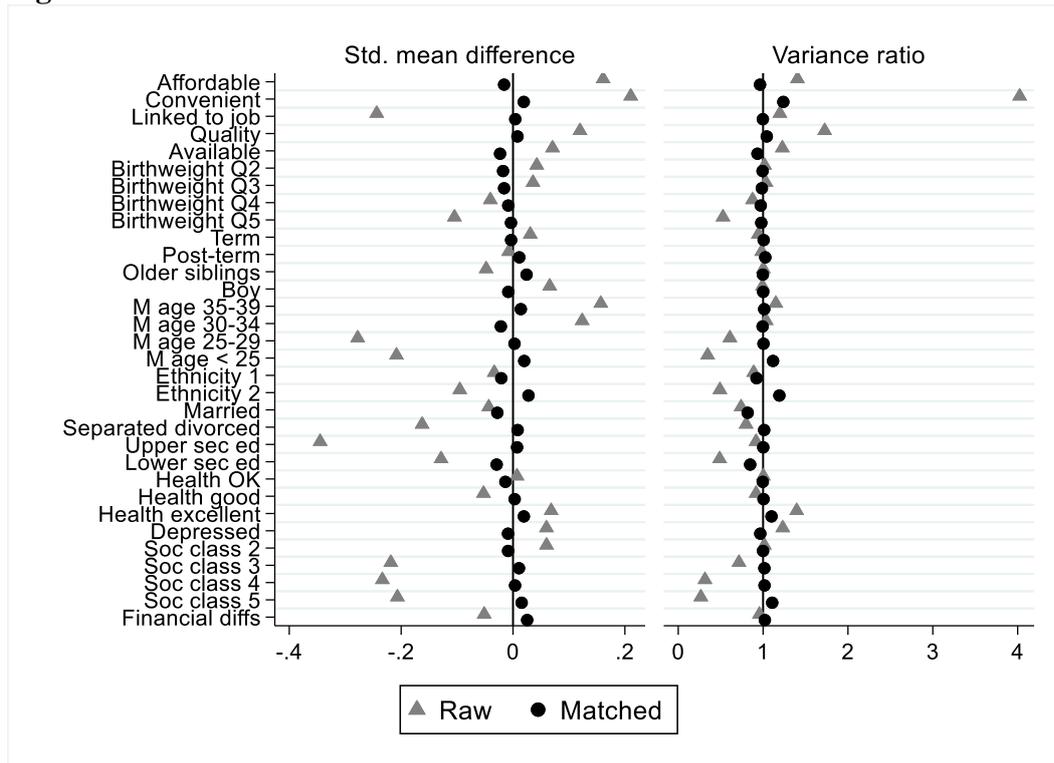
Figure 2: Propensity score distributions and common support



Source: Growing Up in Ireland. Wave 1.

Note: Covariates: main reason for choosing type of childcare, birth weight, gestation, whether there are older siblings, pupil's gender, mother age, mother ethnicity, mother marital status, whether lone mother, mother highest qualification, mother health status, whether mother depressed, household social-class, earning quintile, house tenure status, whether financially struggling.

Figure 3: Balance measures of covariates



Source: Growing Up in Ireland. Wave 1.

Note: Covariates: main reason for choosing type of childcare, birth weight, gestation, whether there are older siblings, pupil's gender, mother age, mother ethnicity, mother marital status, whether lone mother, mother highest qualification, mother health status, whether mother depressed, household social-class, earning quintile, house tenure status, whether financially struggling.

Table 1: Descriptive statistics of childcare characteristics by childcare type

	Non-centre-based	Centre-based
Number of other children in care setting (%)		
0 (i.e. 1:1 ratio)	35.99	0
1	26.82	3.34
2-3	26.20	12.07
4-9	10.71	49.68
>9	0.29	34.92
Travel distance (%)		
0-9 mins	48.69	44.44
10-19 mins	33.56	36.47
>19 mins	17.75	19.09
Main reason of choice (%)		
Only one affordable	3.72	1.56
Convenient to my home	11.16	16.73
Linked to my job	1.10	4.57
Quality of care provided	72.87	61.49
Only one available	3.20	5.66
Other	7.96	9.99
Determined by financial constraints (%)		
Completely/Large extent	14.65	10.83
Some degree/A little	33.30	38.63
Not at all	52.05	50.54
Pay p/w (%)		
<=49€	33.27	3.75
50-90€	22.30	12.83
100-200€	44.43	83.42
Hours p/w	24.28	30.68
Days p/w	3.57	4.13
Obs.	2097 (72%)	830 (28%)

Source: Growing Up in Ireland. Wave 1.

Note: sample of working mothers also observed at wave 3 (age 5).

Table 2: PSM results, centre-based childcare and socio-emotional skills at age 5

	ATE	ATT	ATU
Internalizing	0.010 (0.051)	-0.028 (0.054)	0.025 (0.058)
Externalizing	-0.176*** (0.050)	-0.148*** (0.058)	-0.187** (0.058)
Total	-0.121*** (0.046)	-0.120*** (0.048)	-0.121** (0.055)
Pro-social	-0.040 (0.051)	-0.011 (0.056)	-0.052 (0.057)
Obs.	2549	2549	2549

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills measured at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table 3: PSM results, centre-based childcare and socio-emotional skills at age 3

	ATE	ATT	ATU
Internalizing	0.129*** (0.051)	-0.086 (0.062)	0.148*** (0.053)
Externalizing	0.031 (0.047)	-0.015 (0.056)	0.037 (0.053)
Total	0.086* (0.046)	0.053 (0.056)	0.099** (0.051)
Pro-social	0.134*** (0.052)	0.171*** (0.059)	0.112** (0.057)
Obs.	2549	2549	2549

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills measured at age 3. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table 4: Heterogeneity by mother's education

	Mother with degree			Mother without degree		
	ATE	ATT	ATU	ATE	ATT	ATU
Internalizing	-0.022 (0.056)	-0.034 (0.067)	-0.014 (0.061)	0.138 (0.086)	0.098 (0.081)	0.148 (0.095)
Externalizing	-0.066 (0.062)	-0.083 (0.069)	-0.057 (0.071)	-0.180* (0.102)	-0.139 (0.090)	-0.191* (0.117)
Total	-0.058 (0.053)	-0.077 (0.062)	-0.048 (0.060)	-0.058 (0.093)	-0.050 (0.091)	-0.060 (0.104)
Pro-social	-0.077 (0.060)	-0.039 (0.070)	-0.098 (0.065)	-0.018 (0.085)	-0.035 (0.085)	-0.014 (0.096)
Obs.	1389	1389	1389	1351	1351	1351

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills measured at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table 5: Heterogeneity by child sex

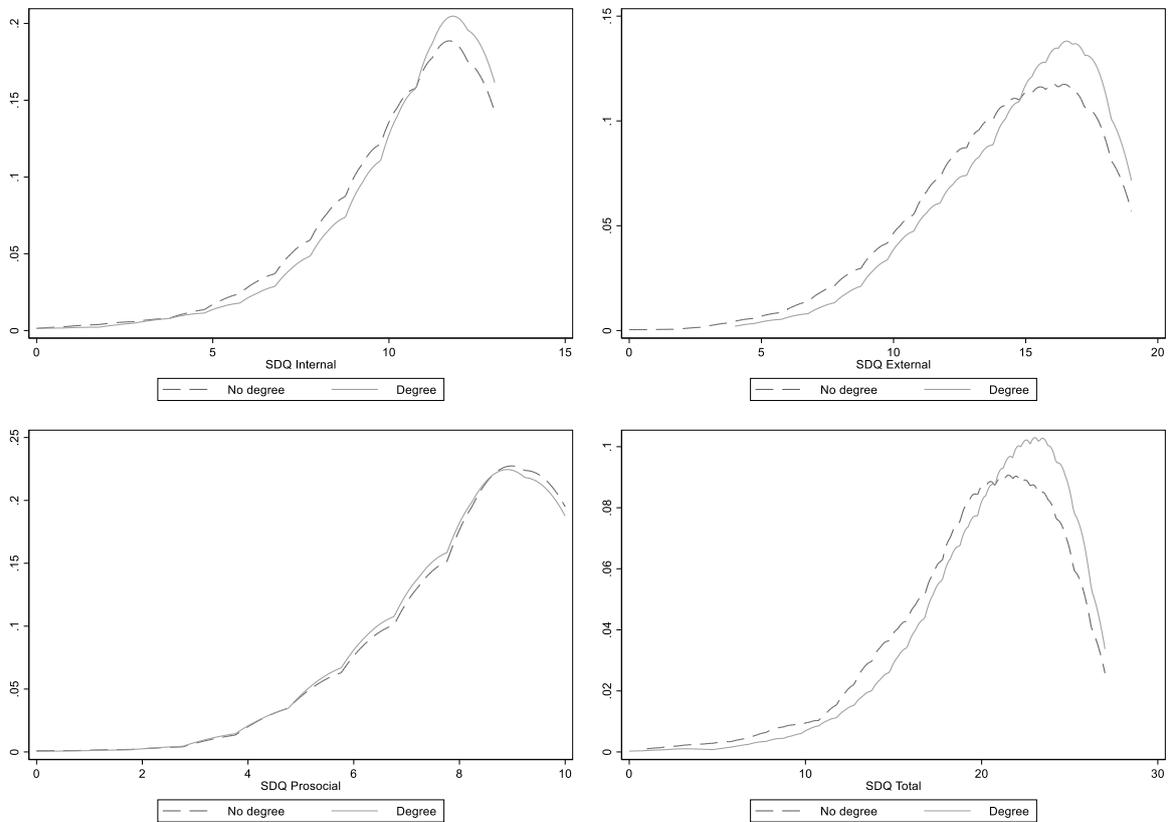
	Girls			Boys		
	ATE	ATT	ATU	ATE	ATT	ATU
Internalizing	0.004 (0.070)	-0.068 (0.084)	0.031 (0.076)	0.008 (0.068)	0.029 (0.073)	-0.001 (0.077)
Externalizing	-0.115 (0.085)	-0.113 (0.084)	-0.107 (0.096)	-0.230*** (0.075)	-0.172** (0.078)	-0.255*** (0.088)
Total	-0.080 (0.076)	-0.013 (0.087)	-0.061 (0.085)	-0.160** (0.072)	-0.108 (0.076)	-0.183** (0.085)
Pro-social	0.010 (0.074)	-0.006 (0.078)	0.016 (0.082)	-0.175*** (0.070)	-0.112 (0.074)	-0.202*** (0.082)
Obs.	1290	1290	1290	1416	1416	1416

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills measured at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Appendix

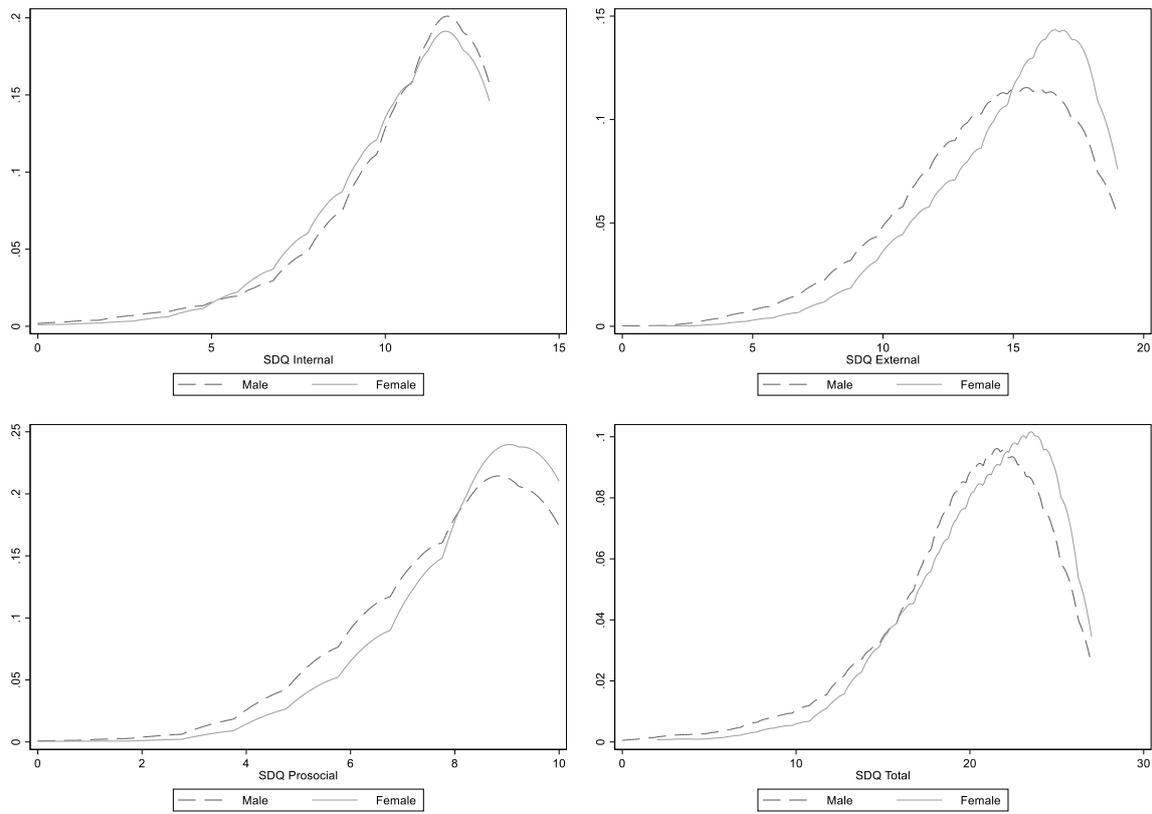
Figure A1. Socio-emotional skills: internalizing, externalizing, pro-social and total scores at age 5, by maternal education



Source: Growing up in Ireland. Wave 3.

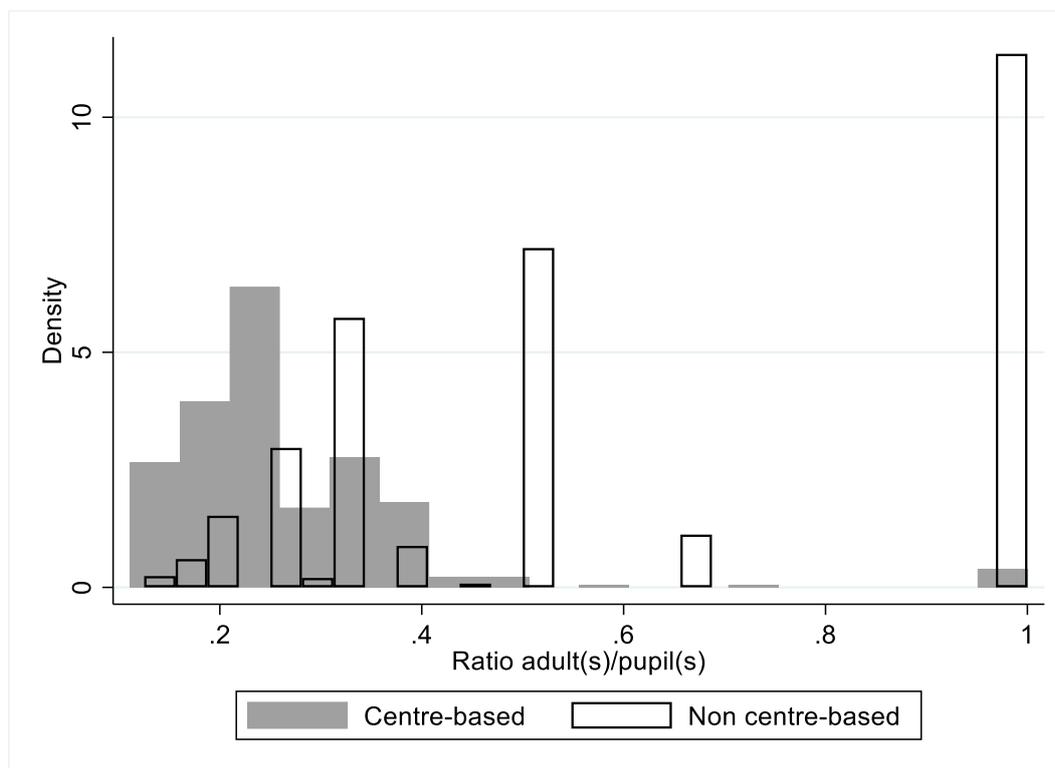
Note: maternal education measured at age nine months and socio-emotional skills measured at age 5.

Figure A2. Socio-emotional skills: internalizing, externalizing, pro-social and total scores at age 5, by sex of child



Source: Growing up in Ireland. Wave 3.
Note: socio-emotional skills measured at age 5.

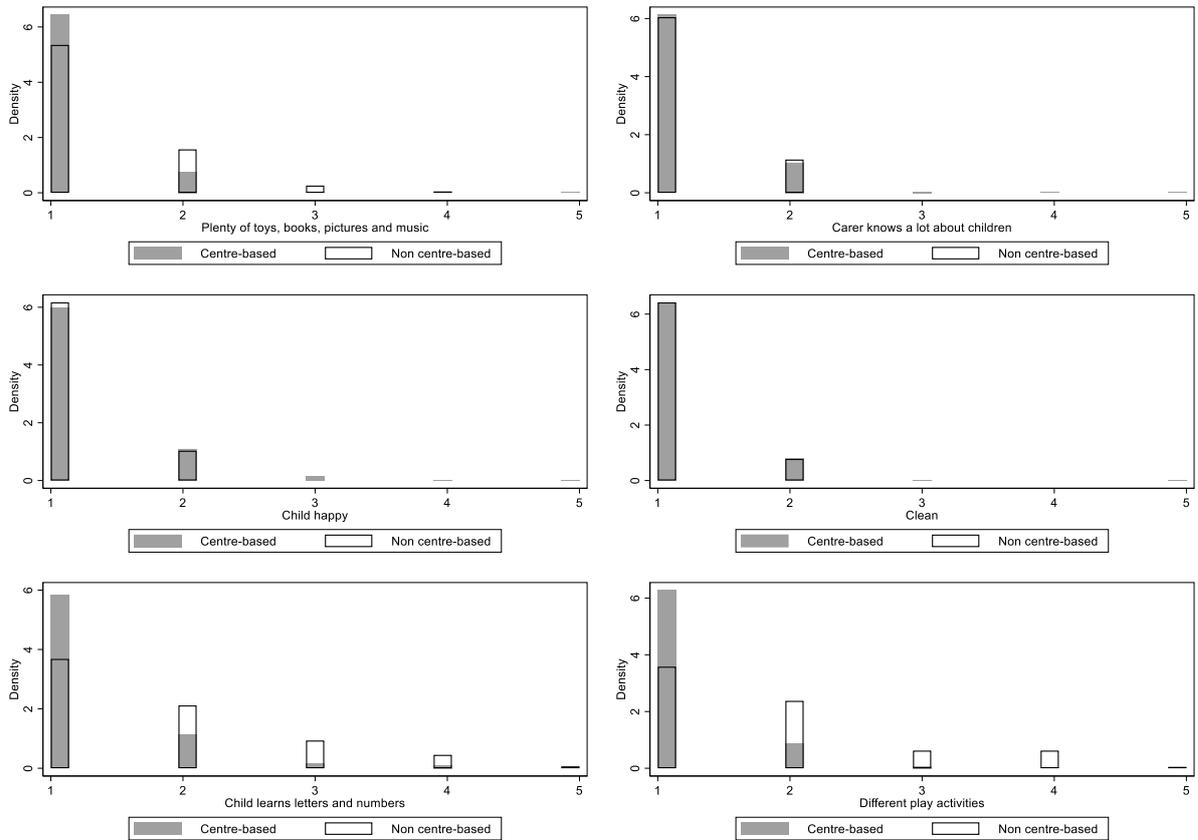
Figure A3. Ratio of adult(s)/children by childcare type at age 3



Source: Growing Up in Ireland. Wave 2.

Note: The ratio of adult(s)/children in the same room while in childcare is only available for 42% of the sample as, by construction, this variable is censored above 9 children and 5 adults in the same room. Above these numbers the responses are grouped.

Figure A4. Characteristics of childcare by childcare type at age 3



Source: Growing Up in Ireland. Wave 2.

Note: Characteristics by childcare type at age 3. 1 stands for “strongly agree”, 2 for “agree”, 3 for “neither agree or disagree”, 4 for “disagree”, and finally 5 for “strongly disagree”. Measures only available for two-thirds of the sample.

Table A1. Mother, child and household characteristics when the child was nine months old, by sample

		Mums working at 9m		
		Whole sample	Non-centre-based childcare	Centre-based childcare
Children/birth characteristics	Birthweight			
	>=4 kg	19.93	20.47	19.49
	3.5-3.9 kg	38.01	39.55	41.64
	3-3.4kg	29.58	28.56	30.2
	2.5-2.9kg	8.78	7.95	6.86
	<2.5kg	3.69	3.47	1.81
	Gestation term			
	PreTerm (<37GW)	4.59	4	3.13
	Term (37-41 GW)	83.67	83.58	84.72
	PostTerm (>41 GW)	11.74	12.42	12.15
	Older siblings			
	Yes	60.14	51.98	49.7
	Child sex			
Female	49.14	48.74	45.49	
Mother characteristics	Age			
	40+	6.87	5.14	6.38
	35-39	28.09	26.27	33.45
	30-34	36.82	39.89	46.09
	25-29	19.98	22.51	12.03
	20-24	8.25	6.19	2.05
	Ethnicity			
	Irish	83.48	90.43	92.66
	White other	11.39	7.09	6.14
	Other	2.47	2.48	1.2
	Marital status			
	Married	71.21	72.49	79.9
	Sep/divorced	2.8	2.33	1.68
	Never married	25.99	25.18	18.41
	Lone mother			
	Yes	9.5	7	2.53
	Highest qualification			
	Tertiary	38.40	43.46	62.58
	Upper secondary	52.06	52.21	35.38
	Lower secondary or less	9.54	4.33	2.05
Health scale				
1	31.92	35.32	35.74	
2	39.85	42.03	42.48	
3	22.50	19.47	17.33	
4	5.13	3.19	4.45	
Currently miserable or depressed				

	Yes	9.39	6	7.46
Household characteristics	Social class			
	Professional workers	19.98	21.28	35.26
	Managerial and technical	33.15	42.93	45.97
	Non-manual	16.99	24.18	15.52
	Skilled manual	12.90	6.95	2.05
	Semi-skilled	7.11	4.66	1.2
	Unskilled/Never worked	9.87	0	0
	Equivalised Household Annual Income - Quintiles			
	bottom fifth	16.71	5.81	2.77
	second fifth	16.65	10.47	5.9
	third fifth	18.37	19.37	13.72
	fourth fifth	21.80	33.84	27.32
	top fifth	19.96	25.04	46.57
	Unknown	6.52	5.47	3.73
	Has difficulty making ends meet			
	Yes	41.06	31.6	29.12
	Housing tenure			
	Owner occupation	73.01	83.48	88.33
	Public (LA) rented	6.56	2.57	1.68
	Private rented	18.95	12.09	9.39
	Other	1.48	1.86	0.6
Observations		8178	2097	830

Source: Growing Up in Ireland. Wave 1.

Note: in the first column all mothers of singleton who also are the main respondents across the first three waves are included. The second and third columns is restricted to the subsample of working mothers when child is 9 months.

Table A2. Heterogeneity by mother's education (age 3 outcomes)

	Mother with degree			Mother without degree		
	ATE	ATT	ATU	ATE	ATT	ATU
Internalizing	0.156*	0.156*	0.156	0.080	0.120*	0.057
	(0.094)	(0.087)	(0.108)	(0.055)	(0.064)	(0.055)
Externalizing	0.064	0.061	0.064	0.003	0.012	-0.002
	(0.079)	(0.085)	(0.086)	(0.054)	(0.067)	(0.055)
Total	0.131*	0.077*	0.145*	0.041	0.067	0.026
	(0.069)	(0.075)	(0.076)	(0.055)	(0.067)	(0.055)
Pro-social	0.123	0.121	0.123	0.174***	0.173**	0.175***
	(0.084)	(0.089)	(0.093)	(0.061)	(0.080)	(0.061)
Obs.	1389	1389	1389	1351	1351	1351

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills at age 3. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table A3. Heterogeneity by child sex (age 3 outcomes)

	Girls			Boys		
	ATE	ATT	ATU	ATE	ATT	ATU
Internalizing	0.002	0.012	-0.001	0.202***	0.164***	0.218***
	(0.070)	(0.072)	(0.082)	(0.059)	(0.063)	(0.070)
Externalizing	-0.016	-0.079	0.007	0.041	0.019	0.051
	(0.065)	(0.066)	(0.078)	(0.067)	(0.051)	(0.077)
Total	-0.011	-0.054	0.005	0.127**	0.093	0.143*
	(0.066)	(0.067)	(0.079)	(0.064)	(0.064)	(0.076)
Pro-social	0.026	0.031	0.025	0.176***	0.223***	0.156**
	(0.060)	(0.077)	(0.063)	(0.066)	(0.067)	(0.078)
Obs.	1290	1290	1290	1416	1416	1416

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills at age 3. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table A4. PSM results centre-based childcare at age nine months socio-emotional skills at age 5, results from teacher report of socio-emotional outcomes

	ATE	ATT	ATU
Internalize	-0.066 (0.049)	-0.068 (0.056)	-0.066 (0.055)
Externalize	-0.148** (0.061)	-0.125** (0.054)	-0.157** (0.070)
Total	-0.140*** (0.057)	-0.124** (0.056)	-0.147** (0.064)
Pro-social	-0.078* (0.045)	-0.089** (0.047)	-0.074 (0.051)
Obs.	2549	2549	2549

Source: Growing Up in Ireland. Wave 1-3.

Note: subsample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.001$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table A5. PSM results by intensity of childcare

	1-3 days p/week			4/5 days p/week		
	ATE	ATT	ATU	ATE	ATT	ATU
Internalize	-0.004 (0.083)	-0.050 (0.073)	0.008 (0.098)	0.069 (0.067)	0.075 (0.069)	0.066 (0.078)
Externalize	-0.127 (0.089)	-0.120 (0.085)	-0.128 (0.098)	-0.223*** (0.060)	-0.147** (0.063)	-0.265*** (0.078)
Total	-0.092 (0.082)	-0.111 (0.077)	-0.087 (0.092)	-0.125** (0.064)	-0.067 (0.064)	-0.156** (0.080)
Pro-social	-0.043 (0.091)	-0.119 (0.096)	0.023 (0.103)	-0.043 (0.065)	-0.015 (0.070)	-0.059 (0.076)
Obs.	1160	1160	1160	1525	1525	1525

Source: Growing Up in Ireland. Wave 1-3.

Note: sample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.001$. Results were comparable if we split by number of hours of childcare rather than number of days. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table A6. PSM results, socio-emotional skills at age 5 and childcare at age 3

	ATE	ATT	ATU
Internalizing	-0.015 (0.043)	-0.032 (0.050)	-0.006 (0.049)
Externalizing	-0.187*** (0.046)	-0.157*** (0.050)	-0.202*** (0.054)
Total	-0.141*** (0.045)	-0.129*** (0.049)	0.148*** (0.053)
Pro-social	-0.087** (0.043)	-0.092** (0.048)	-0.085* (0.050)
Obs.	2751	2751	2751

Source: Growing Up in Ireland. Wave 1-3.

Note: subsample of working mothers when child is 9 months. Childcare measured at age 3 and socio-emotional skills at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.

Table A7. IV results, socio-emotional skills at age 5

	OLS	2SLS
Internalizing	-0.024 (0.040)	0.036 (0.077)
Externalizing	-0.137*** (0.040)	-0.256*** (0.080)
Total	-0.111*** (0.040)	-0.165** (0.078)
Pro-social	-0.046 (0.041)	-0.122 (0.079)
Obs.	2927	2927

Source: Growing Up in Ireland. Wave 1-3.

Note: subsample of working mothers when child is 9 months. Childcare measured at age 3 and socio-emotional skills at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.01$. The first column reports the estimates of centre-based childcare from a linear probability model while the second reports the 2 stages-least square estimates. In the first stage the probability of being in centre-based childcare at age 3 is instrumented with being in centre-based childcare at 9 months. This is not a weak instrument: the estimated coefficient (s.e.) of centre-based childcare at 9 months is 0.547*** (0.018), the F-stat 903.2, and the p-value of the Kleibergen-Paap test of weak instrument is 0.000. The control variables included are the same of those used to implement matching and the standard errors are robust.

Table A8. IPW results centre-based childcare at age nine months and socio-emotional skills at age 5

	ATE	ATT	ATU
Internalizing	0.032 (0.049)	-0.005 (0.046)	0.047 (0.055)
Externalizing	-0.167*** (0.056)	-0.142*** (0.048)	-0.176*** (0.064)
Total	-0.103** (0.053)	-0.104** (0.047)	-0.102* (0.061)
Pro-social	-0.062 (0.047)	-0.070 (0.046)	-0.059 (0.052)
Obs.	2927	2927	2927

Source: Growing Up in Ireland. Wave 1-3.

Note: Subsample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.001$.

Table A9. PSM results from the Millennium Cohort Study, centre-based childcare and socio-emotional skills at age 5

	ATE	ATT	ATU
Internalizing	0.106*** (0.034)	0.036 (0.040)	0.122*** (0.038)
Externalizing	-0.099** (0.050)	-0.077** (0.034)	-0.103* (0.057)
Total	-0.021 (0.044)	-0.039 (0.037)	-0.017 (0.050)
Pro-social	-0.033 (0.048)	0.003 (0.043)	-0.041 (0.053)
Obs.	5096	5096	5096

Source: Millennium Cohort Study. Wave 1-3.

Note: subsample of working mothers when child is 9 months. Childcare measured at age 9 months and socio-emotional skills at age 5. * $\rho < 0.10$, ** $\rho < 0.05$, *** $\rho < 0.001$. Kernel matching with common support; bootstrapped standard errors (100 replications). Obs. refers to matched treated and control observations.