

Which Children Benefit From Non-Parental Care?*

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Abstract

Although the impact of non-parental care on children has been widely analysed, there is still little consensus in the literature. This is due in part to the issue of selection: if families who choose parental care are different from those who opt for non-parental care, the observed association between outcomes and care may not be causal. We address this using four strategies: controlling for a wide array of observable characteristics (including lagged outcomes), using propensity score matching, estimating unobservables bias by looking at selection on observables, and instrumenting use of care with supply-side or demand-side shocks. We find that non-parental care is associated with worse behavioural outcomes, but that the magnitude of the difference is quite small. Moreover, we cannot reject the hypothesis that our effects are solely due to selection. To the extent that we observe differential impacts, the association between non-parental care and behavioural outcomes appears to be more negative in high-SES families, and less negative in day care centres with smaller group sizes (though again, these relationships may not be causal).

Keywords: child care, early childhood, selection

JEL Codes: J13, I20

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1. Introduction

A large number of small children are being looked after by adults who are not their parents, such as relatives, nannies, formal day care, and informal child care. The growing maternal labour force participation and interest in early childhood education are likely to further increase the usage of centre-based care. These trends suggest that it is important to know how different childcare arrangements, particularly centre-based care, affect children's development. In particular, children's non-cognitive skills or behavioural outcomes have been recently found to be associated with future successes (Heckman and Rubinstein, 2001; Blanden, Gregg, and Macmillan, 2007).

While available evidence indicates that demonstration projects (which randomly provided high-quality, comprehensive services to disadvantaged children) have a positive impact on children's cognitive skills and behavioural outcomes,¹ evidence is relatively scarce on the impact of ordinarily available childcare on behavioural outcomes. In addition, it has not yet been clearly shown why the results for demonstration projects and those for ordinarily available childcare differ.²

This paper analyses the relationship between children's behavioural outcomes and the use of different types of non-parental care, with the particular focus on the use of formal care whose quality could be modified by policy. In addition, we explore why the impact of ordinarily available childcare might be different from the impact of demonstration programs, by testing for differential effects across groups of parents (broken down by income and education), and differential effects by quality of care (as measured by the carer/child ratio, the proportion of qualified carers, and expert assessments).

We use several strategies to reduce a possible bias in our results due to unobserved heterogeneity in parental taste, which is correlated with childcare choice. First, we include a wide range of controls for observable characteristics, including socioeconomic background, parenting style, and lagged outcome measures. Second, we use matching estimators to ensure

¹ Blau and Currie (2004) provide an excellent summary of early childhood intervention programs using randomized trials. In particular, they review the impact on behavioural outcomes in the long-run, such as reductions in remedial education placements, grade repetitions, and school dropouts.

² For example, a recent report to the Australian Senate urgently advocated more research on the effect of formal daycare on children's outcomes (see Education, Employment and Workplace Relations References Committee 2009, Recommendation 1).

that childcare users and non-users are as similar as possible. Third, we use instrumental variables (IVs) to identify the effect of the use of centre-based care induced by plausibly exogenous shocks in the supply and demand for centre-based care. Our outcome variables, parent-reported measures of child behaviour when their children were aged 2-3 years, have the advantage of being measured at an age before children begin formal schooling – thus ensuring that our estimates are not confounded by differences in kindergarten quality or attendance.

One of our major findings is that non-parental care, and in particular centre-based care, is associated with worse behavioural outcomes. However, the magnitude of the difference between centre-based care users and children who do not use non-parental care is quite small. Moreover, we cannot reject the hypothesis that our effects are solely due to selection. Our second set of findings is that the association between non-parental care and behavioural outcomes is more negative in high-SES families, and less negative in centres with a higher carer/child ratio.

Our overall findings are similar to previous studies implying a negative association between exposure to formal care and behavioural outcomes. For example, Magnuson, Ruhm and Waldfogel (2004) found that children attending childcare or preschool are more likely to exhibit behavioural problems. Herbst and Tekin (2008) also observe a negative relationship between childcare subsidy receipt and children's behavioural outcomes.³ However, as in Loeb et al. (2007), who instrument for usage of centre-based care with the number of childcare establishments, we cannot rule out the possibility that the effects we observe are merely due to selection on unobservables.

One paper that does find a substantial negative effect of formal child care is Baker, Gruber, and Milligan (2008), who analyse a Quebec policy change, and conclude that higher levels of formal day care usage led to an increase in behavioural and health problems (relative to the rest of Canada). Since their results are identified from a major policy change, while ours are driven by smaller differences across individuals and (in the case of our IV specifications)

³ On the other hand, Lee, Brooks-Gunn, Schnur, and Liaw (1990) observed the positive effect of Head Start on a measure of children's integration into a preschool program. One of the reasons that the results of Lee et al. (1990) differ from the other studies might be that the outcome measure used by Lee et al. (1990) was not a standardized behavioural score, but was based on kindergarten teachers' subjective ratings.

regions, it is not particularly surprising that our results are not as strong as those of Baker, Gruber, and Milligan (2008).

Our results also indicate that the negative association between behavioural outcomes and exposure to non-parental care is larger for high-SES children. This is in line with Loeb et al. (2007), who show that intensive use of centre-based care is significantly associated with a lower social-behavioural score only among middle-income and high-income families.⁴ Although there could be a variety of explanations for this, there is some evidence that the difference is due to higher-quality parenting among richer and better-educated households. For example, Bianchi and Robinson (1997) report that children of higher-educated parents are more likely to read books, and less likely to watch television, Evans (2004) surveys a number of similar results, including the finding that more affluent parents are less likely to use corporal punishment. Guryan, Hurst, and Kearney (2008) find that higher-educated parents spend more time with their children (despite the fact that higher-educated parents also spend more time working outside the home). Observing parent-child interactions among a small sample of families with children aged under 3 years, Hart and Risley (1995, p.239) found that professional parents addressed about 2000 words per hour to their children, while parents receiving welfare benefits addressed about 500 words per hour to their children. For Australia, Yamauchi (2010) finds that highly educated parents use better disciplinary methods, and engage in more education-oriented activities with their children. In this context, we would expect non-parental care to have a larger adverse effect (or a smaller positive effect) in high-SES households.

Exploring heterogeneity by the quality of non-parental care, we find that most of our quality proxies are statistically insignificant, but we do observe some suggestive evidence that smaller group sizes mitigate the negative impact of non-parental care. This makes some intuitive sense, since a higher carer/child ratio increases the amount of time a child receives from a caregiver, and possibly raises the quality of the care as well.

⁴ Heterogeneity is also found in the association between exposure to centre-based care and children's cognitive outcomes (Hill, Waldfogel and Brooks-Gunn (2002). Exploiting randomization and matching estimators, Hill, et al. (2002) found positive cognitive impacts of high-quality centre-based care for children from disadvantaged families. These positive impacts were larger for children who would otherwise have received low-quality centre-based care than they were for children who would otherwise have received home-based or parental care.

The remainder of the paper is structured as follows. In section 2, we describe the data and empirical strategy. In section 3, we present our main results. We extend on this in Section 4 by presenting various robustness checks, and in Section 5 by exploring heterogeneity across parental socioeconomic status. The final section concludes.

2. Data and empirical strategy

Our analysis is based on data from the birth cohort of the Longitudinal Survey of Australian Children (LSAC), which collected data from around 5000 children in 2004 (when they were aged 0 or 1 years) and in 2006 (when they were aged 2 or 3 years). The longitudinal nature of the dataset is helpful for our purposes, since it allows us to include controls for parenting style and child outcomes that were measured in the first wave of the survey.

The outcome measure that we focus upon is the ‘Short Temperament Scale for Infants’ (STSI), which is based on a parental survey. There are three component indices in the STSI. The first is an approach scale, based on questions such as whether the child laughs when arriving at unfamiliar places, smiles when playing with unfamiliar adult, and is outgoing with strangers. The second is a persistence scale, which is based on questions such as whether the child plays consistently with a toy for more than 10 minutes, or returns to the same activity after a short toilet break. The third is a reactivity scale, which captures whether the child has a tendency to scream or yell in response to frustration, has moody days, and stomps feet when upset. We recode the three indices as z-scores (i.e. with a mean of zero and a standard deviation of one), and so that a higher score represents better behaviour. We also create a composite index, which is the mean of the approach, persistence and reactivity scales, and also has a mean of zero and a standard deviation of one.

We use three measures of non-parental care. The first is an indicator variable denoting whether the child was in non-parental care at the time of the age 2–3 interview, while the second is an indicator variable denoting whether the child was in *full-time* non-parental care at the time of the age 2-3 interview. Our third measure is somewhat more complex, being the share of time that the child was in non-parental care from the age 0-1 interview to the age 2–3 interview. For the third measure, a child who was always in parental care would be coded 0, while a child who was in full-time non-parental care would be coded 1. A child who was in half-time non-parental care for the full duration between the interviews would be coded 0.5.

Similarly, a child who was in full-time non-parental care for half the duration between the interviews would be coded 0.5. More details of this measure are provided in the Data Appendix. Although our analysis begins by simply comparing parental care and non-parental care, we also look separately at three types of non-parental care: centre-based care, family day care, and informal care. Summary statistics for the key variables are presented in Appendix Table 1.

To account for the possibility that the use of non-parental care might be correlated with factors that have a direct impact on the STSI outcome measures, all our regressions include five sets of controls. In choosing these variables, we have been guided by the previous literature, particularly NICHD and Duncan (2003) and Duncan and Gibson-Davis (2006).

- **Child controls:** Indigenous, born in a non-English speaking country, gender, age (2 month bands).
- **Parents controls:** Indigenous, non-English speaking, born in a non-English speaking country, age, age², education (6 categories), present at interview.
- **Household controls:** household income (6 categories), number of siblings, family size, parents' relationship (married/defacto/single)
- **Parenting style controls:** self-assessment of parenting quality and style, parents' mental wellbeing (all measured when children were aged 0/1)
- **Lagged temperament score controls:** standardized scores for three STSI indices based on a parental questionnaire administered at age 0/1. The three indices are approachability, cooperativeness and irritability, and each of the indices is based on four questions. For example, questions related to approachability are whether the baby is pleasant when first arriving in unfamiliar places and whether the baby's first reaction to approach by strangers is acceptance; questions related to cooperativeness are whether the baby stays still during procedures like hair brushing or nail cutting and whether the baby makes happy sounds (coos, smiles, laughs) when being changed or dressed; questions regarding irritability are whether the baby is fretful on waking up and/or going to sleep and whether the baby amuses him or herself for half an hour or more in cot or playpen (looking at mobile, playing with toy, etc.). Parents answered on the 1 (almost never) through 6 (almost always) frequency scale. After each answer was standardized, four answers for each personality attribute were summed for

children for whom more than half of the questions per attribute were answered. The resulting variables are used in the analysis.

Where Y is an outcome index for child i in survey wave t , $CareType$ is a variable (or vector of variables) denoting non-parental care, $Child$, $Parent$, $Household$, $ParentingStyle$ and $LaggedTests$ are vectors of control variables as defined above, our main estimating equation is:

$$Y_{it} = \alpha + \beta CareType_{it} + \gamma 1 Child_{it} + \gamma 2 Parent_{it} + \gamma 3 Household_{it} + \gamma 4 ParentingStyle_{it} + \gamma 5 LaggedTests_{it-1} + \varepsilon_{it} \quad (1)$$

In this equation, the parameter β represents the marginal effect of non-parental care, holding constant other control variables.

To account for the possibility that non-parental care might have a heterogeneous effect on children, we also estimate an equation in which non-parental care is interacted with measures of the parents' socioeconomic status – being either tertiles in annual household income (less than \$42,000, \$42,001-\$78,000, or over \$78,000), or tertiles in the education of the primary parent (high school dropout, finished year 12, or university graduate).

Since Equation 1 already includes controls for household income and parental education, it is unnecessary to include the main effects of being in one of the three SES tertiles. We therefore present a ‘fully interacted’ specification in which each of the three parental SES categories are interacted with an indicator for use of non-parental care. We then estimate the equation:

$$Y_{it} = \alpha + \beta 1 HighSES_{it} \times CareType_{it} + \beta 2 MidSES_{it} \times CareType_{it} + \beta 3 LowSES_{it} \times CareType_{it} + \gamma 1 Child_{it} + \gamma 2 Parent_{it} + \gamma 3 Household_{it} + \gamma 4 ParentingStyle_{it} + \gamma 5 LaggedTests_{it-1} + \varepsilon_{it} \quad (2)$$

3. Main Results

Since standardized behavioural scores are not necessarily an intuitive metric for performance, we regress the behavioural scores on the child's age (in years). This returns a coefficient of

around 0.2 for the composite and persistence indices, suggesting that around ages 2–3 years, children gain about 1/5th of a standard deviation per year on these tests. Thus an effect of 0.2 for the composite or persistence indices can be viewed as equivalent to one year’s development. Unfortunately, the other two indices are not significantly related to the child’s age, so we cannot use a simple developmental rule-of-thumb in the case of those measures.

We begin by presenting the results for a specification in which the key independent variable is whether the child is in non-parental care at the time of the age 2–3 interview. In Panel A, we combine centre-based care, family day care and informal care into a single category of ‘non-parental care’. The conditional association between non-parental care and the approachability index is positive and significant, while the other three indices are negative, though not significant.⁵

In Panel B, we analyse the three types of care separately. For centre-based care, which is the form of care with perhaps the most policy relevance, the approachability index is positive and significant, while the reactivity index is negative and significant. This would be consistent with a model in which using centre-based care makes children better able to interact with strangers, but also increases the number of temper tantrums.

⁵ The number of observations used in the regression analysis is smaller than the full sample size of about 5000, mainly because the outcome variables were not answered by a large number of children.

Table 1: Current non-parental care

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Currently using any non-parental care	-0.012 [0.042]	0.095** [0.044]	-0.056 [0.043]	-0.056 [0.043]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14
Panel B				
Currently using centre-based care	-0.044 [0.039]	0.075* [0.040]	-0.053 [0.040]	-0.100** [0.040]
Currently using family day care	-0.045 [0.070]	0.123* [0.072]	-0.121* [0.070]	-0.081 [0.069]
Currently using informal care	-0.02 [0.041]	0.039 [0.042]	-0.032 [0.042]	-0.042 [0.044]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

In Table 2, we analyse current use of full-time non-parental care. Pooling centre-based care, family day care and informal care (Panel A), the coefficients on full-time non-parental care are negative, but insignificant for the persistence and reactivity indices, and only significant at the 10 percent level for the composite and approach indices. Separately analysing the three types of non-parental care, the coefficients are generally insignificant and close to zero, with the exception of the composite index for centre-based care (-0.1), and the approachability index for family day care (-0.2).

If we were to interpret the above results causally, they would suggest that children in full-time centre-based care at the time of the age 2/3 interview score 0.1 standard deviations lower on the composite index than children who were not in any form of non-parental care. Recall from above that 0.2 standard deviations constitute a year of development on the composite

index. Therefore, another way of interpreting this is that children in full-time centre based care are 6 months behind in terms of the composite index. However, these coefficients should not necessarily be interpreted causally, an issue we return to below.

Table 2: Current full-time non-parental care

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Currently using any FT non-parental care	-0.082* [0.044]	-0.076* [0.044]	-0.027 [0.044]	-0.050 [0.044]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.13	0.14
Panel B				
Currently using FT centre-based care	-0.103** [0.052]	-0.085 [0.052]	-0.049 [0.051]	-0.060 [0.051]
Currently using FT family day care	-0.071 [0.106]	-0.209** [0.104]	-0.003 [0.106]	0.084 [0.095]
Currently using FT informal care	-0.038 [0.076]	-0.012 [0.076]	-0.004 [0.083]	-0.053 [0.078]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. 'FT' means full-time.

In Table 3, we use a third measure of non-parental care, which is the child's exposure to non-parental care from the time of the age 0/1 interview until the time of the age 2/3 interview. Where the other measures are discrete variables, this is a continuous measure, ranging from zero (no exposure) to one (60 hours per week exposure for the full duration between the interviews). Although we observe some children who are in care for 60 hours per week at particular points, no child in our sample is in non-parental care for 60 hours per week throughout the two year period. Accordingly, the maximum value that the non-parental care exposure measure takes is 70 percent, the mean is 7 percent, and the standard deviation is 9

percent. This is important to bear in mind when comparing the magnitudes in Table 3 to those in Tables 1 and 2.

The results in Table 3 indicate that greater exposure to non-parental care is associated with significantly lower scores on the reactivity index and the composite index. The associations with the reactivity index are the largest, with a 10 percentage point increase in exposure to non-parental care (approximately one standard deviation) associated with a 0.06 to 0.09 standard deviation drop in the reactivity index. The results for the composite index are also negative and significant (except for informal care), indicating that the lower scores on the reactivity index are not offset by higher scores on the approachability and persistence indices.

Table 3: Exposure to non-parental care over the previous 2 years

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Exposure to non-parental care	-0.430** [0.201]	-0.122 [0.200]	-0.046 [0.204]	-0.626*** [0.207]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.13	0.14
Panel B				
Exposure to centre-based care	-0.549** [0.267]	-0.276 [0.277]	-0.188 [0.272]	-0.556** [0.270]
Exposure to family day care	-0.932** [0.452]	0.149 [0.465]	-0.969** [0.452]	-0.916** [0.459]
Exposure to informal care	-0.394 [0.378]	-0.147 [0.330]	0.116 [0.375]	-0.703** [0.342]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

4. Robustness Checks

To what extent can our results be interpreted causally? To test this, we use three strategies. First, we re-estimate the results in Panel A of Tables 1 and 2 using nearest-neighbour

matching, using as a control group only those individuals with a propensity score between 10 percent and 90 percent. Matched results are shown in Table 4. This specification eliminates about one-fifth of the sample in Panel A, and about two-thirds of the sample in Panel B. While the results are broadly comparable with those in Tables 1 and 2, the standard errors are slightly larger. Consequently, only one coefficient in the matched specifications is significant – the reactivity index is 0.13 standard deviation lower among those using any non-parental care than among a matched control group who are currently only using parental care.

Table 4: Matching estimates for current care

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Currently using any non-parental care	-0.057 [0.054]	0.096 [0.080]	-0.073 [0.064]	-0.131** [0.063]
Observations	2300	2300	2300	2300
Panel B				
Currently using any full-time non-parental care	-0.080 [0.058]	-0.017 [0.085]	-0.044 [0.065]	-0.091 [0.071]
Observations	1067	1067	1067	1067

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Regressions are based on nearest neighbour matching, with the sample restricted to observations with a propensity score between 0.1 and 0.9. Robust standard errors in brackets (bootstrapped over 50 replications). * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

Our second robustness check is to apply the approach of Altonji et al. (2005), who employ the novel approach of looking at selection on observables to gauge the potential importance of unobservables bias. For example, in the case of analysing the impact of Catholic school attendance on high school graduation, they observe that omitting observable test scores and parental background would reduce the Catholic high school advantage in graduation rates by one-fifth. In turn, this indicates that unobservables bias would have to be five times larger than observables bias in order to wipe out the Catholic schooling effect. In cases where the econometrician observes a large number of important observable characteristics, the Altonji

et al. method can be useful. While it can never rule out the possibility of unobservables bias, the method provides a useful rule-of-thumb. For a given set of covariates, a smaller observables bias should make us more confident that unobservables bias is unlikely to completely explain the observed effects. The method is well-suited to a case such as this one, where we have a large number of observable covariates, including socioeconomic characteristics, parenting style, and lagged test scores.

In Table 5, we estimate the degree of observables bias for the estimates in Panel A of Tables 1-3, and express the observables bias as a ratio of the point estimate. For example, in Panel B of Table 5, we report that children in full-time non-parental care score 0.8 standard deviations lower on the composite index. This is quite close to the estimated bias from observables, suggesting that unobservables bias would have to be around the same size as the observables bias to wipe out the estimated effect. In Panel C of Table 5, the coefficient on exposure to non-parental care is -0.4, while the bias from observables is -0.3. This suggests that selection on unobservables would have to be larger than selection on observables to fully eliminate the observed association between non-parental care and the composite index.

Table 5: Selection on Observables

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Currently using any non-parental care	-0.012 [0.042]	0.095** [0.044]	-0.056 [0.043]	-0.056 [0.043]
Bias from observables	0.222	0.431	-0.249	0.410
Ratio $ \beta/\text{Bias} $	5%	22%	22%	14%
Panel B				
Currently using any FT non-parental care	-0.082* [0.044]	-0.076* [0.044]	-0.027 [0.044]	-0.050 [0.044]
Bias from observables	-0.079	0.050	-0.278	0.012
Ratio $ \beta/\text{Bias} $	104%	152%	10%	417%
Panel C				
Exposure to non-parental care	-0.430** [0.201]	-0.122 [0.200]	-0.046 [0.204]	-0.626*** [0.207]
Bias from observables	0.303	0.805	-0.983	0.975
Ratio $ \beta/\text{Bias} $	142%	15%	5%	64%

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Betas are the same as those in Panel A of Tables 1, 2 and 3. Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. 'FT' means full-time. Bias from observables is calculated using the approach in Altonji et al. (2005) (see text for details).

As a third robustness check, we estimate instrumental variables models in which the use of centre-based care is instrumented using either a measure of 'surprise births' in the child's Statistical Local Area, a measure of the number of new centre openings, and then with both instruments together. Specifically, our first instrument is the percentage change in the birth rate between 2001–02 (two years before the children in our sample were born) and 2003–04. To the extent that this variation is driven by random factors that are exogenous to parents' preference for centre-based care, an increase in the birth rate should reduce the probability that parents use centre-based care. While centres can respond to demand shocks in the medium-run, supply is not perfectly elastic in the short term, since it takes a number of years to obtain the necessary planning permissions to open a new child care centre. However, a limitation of this approach is that increases in the birth rate may also affect child outcomes via their impact on carer/child ratios in day care centres. Although we believe that these

effects are likely to be relatively small, our data on ratios are extremely noisy, so we are not able to fully rule out this causal channel.

Our second instrument is the number of new centres opened between 2004 and 2006 (normalised by the number of births in 2003-04). As with the demand-side instrument, this supply-side instrument may be partially driven by shifting tastes in particular neighbourhoods. However, because it takes a couple of years to establish a centre, our hope is that much of the variation from this source is exogenous with respect to the characteristics of children in a given neighbourhood. We also show results using both instruments together.

The results from this IV strategy are shown in Table 6. In Panel A (using the supply-shock instrument), we observe that across the four dependent variables, centre-based care is only significant for the approachability index, and then only at the 10 percent level. However, the standard errors are sufficiently large in the IV specification that we cannot reject reasonably large effects of centre-based care in either direction. In Panel B (using the demand-shock instrument), none of the effects are statistically significant. This remains true when we use the two instruments together (Panel C).

Table 6: Instrumenting centre-based care usage

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
<u>Panel A: Instrument is ‘surprise births’</u>				
Currently using centre-based care (instrumented)	-1.621 [1.348]	-2.766* [1.680]	-0.275 [0.952]	0.05 [1.024]
Currently using family day care	-0.822 [0.672]	-1.277 [0.834]	-0.229 [0.474]	-0.007 [0.509]
Currently using informal care	-0.086 [0.075]	-0.079 [0.098]	-0.042 [0.059]	-0.035 [0.061]
Observations	2646	2651	2655	2651
F-statistic on excluded instrument	4.25**	4.44**	4.49**	4.32**
<u>Panel B: Instrument is new centre openings</u>				
Currently using centre-based care (instrumented)	0.483 [0.747]	0.415 [0.922]	-0.333 [0.707]	0.827 [0.728]
Currently using family day care	0.212 [0.376]	0.289 [0.461]	-0.258 [0.350]	0.373 [0.364]
Currently using informal care	0 [0.052]	0.051 [0.057]	-0.045 [0.050]	-0.003 [0.056]
Observations	2642	2647	2651	2647
F-statistic on excluded instrument	8.02***	7.89***	7.95***	8.02***
<u>Panel C: Both Instruments</u>				
Currently using centre-based care (instrumented)	-0.347 [0.520]	-0.926 [0.574]	-0.302 [0.515]	0.562 [0.543]
Currently using family day care	-0.195 [0.268]	-0.37 [0.293]	-0.243 [0.262]	0.243 [0.276]
Currently using informal care	-0.034 [0.046]	-0.003 [0.051]	-0.044 [0.047]	-0.014 [0.050]
Observations	2642	2647	2651	2647
F-statistic on excluded instrument	7.62***	7.68***	7.74***	7.67***

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. In Panel A, use of centre-based care is instrumented using the percentage change in births in the respondent's Statistical Local Area from 2001-02 to 2003-04. In Panel B, use of centre-based care is

instrumented using the number of new centre openings from 2004 to 2006 (divided by the number of births in 2003/2004). In Panel C, both instruments are used together.

Unfortunately, the instrumental variables approach is only useful for estimating the impact of centre-based care, and requires us to assume that the other two types of non-parental care are exogenous. Moreover, while the instruments are reasonably strong if we use *current* care as the endogenous variable, the first-stage is weaker if we use full-time care or exposure as the endogenous variable. Accordingly, we only present results here for current care.

In addition, we experimented with interacting the instruments with the parental socioeconomic status measures used in the next section of the paper. However, in these specifications, the first stage F-statistics for the three endogenous variables are close to zero and statistically insignificant.

A final approach to address the endogeneity of centre-based care is to compare children who use centre-based care with non-users whose parents say that the reason the child did not attend formal care is that they were unable to obtain a place. If such difficulties are random, then those who did not use centre-based care because they were unable to obtain a place are a credible control group for users of centre-based care. However, it is worth noting that only 12 respondents were non-users because they could not obtain a place. While the coefficients in Table 7 are quite similar to those in the primary specification (Panel B of Table 1), only one is statistically significant, being a negative relationship between current use of centre-based care and the reactivity index.

Table 7: Comparing with children who were unable to get a place

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Currently using centre-based care	-0.103 [0.069]	0.055 [0.068]	-0.083 [0.070]	-0.163** [0.073]
Currently using family day care	-0.095 [0.090]	0.105 [0.089]	-0.138 [0.091]	-0.144 [0.093]
Currently using informal care	-0.056 [0.052]	0.02 [0.052]	-0.05 [0.052]	-0.076 [0.055]
Observations	1941	1943	1946	1946
Number of non-users whose could not get a place	12	12	12	12

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

5. Heterogeneous treatment effects

In the previous tables, we have estimated the mean relationship between non-parental care and child outcomes. But from a theoretical perspective, we might expect this relationship to differ substantially across parents. On average, children from high-SES families achieve higher scores on the four behavioural indices. Although there could be a variety of explanations for this, there is some evidence that the difference is due to higher-quality parenting among richer and better-educated households. As we note in section 1, high-SES parents tend to spend more time with their children, are more likely to read books, less likely to watch television, less likely to use corporal punishment, and tend to address more words to their children. In this context, one would expect non-parental care to have a larger adverse effect (or a smaller positive effect) in high-SES households.

To test this, we create two measures of socioeconomic status: household income and the education of the primary parent (who is usually the mother). We then interact these with the

measure of exposure to non-parental care (the main effects of SES are already included as controls). The results from this specification are shown in Panel A of Tables 8 and 9. Consistent with theory, we find that the largest negative associations between behavioural outcomes and non-parental care are for high-SES parents. For example, a 10 percentage point increase in exposure to non-parental care for high-SES children is associated with a 0.07 standard deviation drop in the reactivity index, but no significant change in the reactivity index for low-SES children.

Although we do not find positive effects of care on low-SES children, it is possible that this is because our low-SES grouping is not particularly disadvantaged. In particular, our results are not inconsistent with those from US randomised evaluations (such as Perry Preschool, the Abecedarian Program, or the Early Training Project), since Australian children in a household with an income of \$40,000 in 2004 are still substantially better off than children living below the US poverty line in the 1960s. Another possibility (raised by Blau and Currie 2004) is that demonstration programs have more beneficial impacts on low-SES children than regular centre-based care because they are funded at higher levels and are provided with highly qualified staff.

In Panel B of Tables 8 and 9, we interact the three types of non-parental care separately with the three measures of SES. At this level of disaggregation, the standard errors for most estimates approximately double, so it is difficult to discern patterns as clearly as in Panel A. The clearest pattern appears to be in Panel B of Table 9, where SES is defined by parental education. In this case, the relationship between the composite index and family day care indicates that the greatest negative association is for high-educated parents. A similar pattern can be seen in Panel B of Table 9, in the case of informal care.

Table 8: Exposure to non-parental care over the previous 2 years, interacted with parental income

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Exposure to non-parental care × Low SES	-0.524 [0.451]	0.22 [0.432]	-0.672 [0.525]	-0.489 [0.456]
Exposure to non-parental care × Mid SES	-0.34 [0.299]	-0.241 [0.330]	0.173 [0.311]	-0.562* [0.332]
Exposure to non-parental care × High SES	-0.467 [0.319]	-0.159 [0.297]	0.024 [0.305]	-0.735** [0.315]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14
Panel B				
Exposure to centre-based care × Low SES	-0.485 [0.667]	-0.405 [0.653]	-0.064 [0.743]	-0.405 [0.569]
Exposure to centre-based care × Mid SES	-0.639* [0.388]	-0.359 [0.470]	-0.559 [0.404]	-0.278 [0.426]
Exposure to centre-based care × High SES	-0.483 [0.413]	-0.168 [0.391]	0.078 [0.409]	-0.814* [0.416]
Exposure to family day care × Low SES	-1.106 [0.911]	0.504 [0.946]	-1.329 [0.920]	-1.213 [1.096]
Exposure to family day care × Mid SES	-1.825*** [0.671]	-0.37 [0.734]	-1.782** [0.736]	-1.284** [0.644]
Exposure to family day care × High SES	-0.021 [0.762]	0.396 [0.761]	0.003 [0.752]	-0.441 [0.701]
Exposure to informal care × Low SES	-0.982 [0.871]	0.335 [0.736]	-0.516 [1.003]	-1.653** [0.734]
Exposure to informal care × Mid SES	0.279 [0.499]	0.037 [0.485]	1.047** [0.530]	-0.554 [0.607]
Exposure to informal care × High SES	-0.74 [0.584]	-0.408 [0.497]	-0.408 [0.535]	-0.568 [0.464]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

Table 9: Exposure to non-parental care over the previous 2 years, interacted with parental education

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Exposure to non-parental care × Low SES	0.052 [0.410]	0.556 [0.439]	-0.473 [0.452]	0.005 [0.471]
Exposure to non-parental care × Mid SES	-0.36 [0.358]	-0.222 [0.322]	0.302 [0.323]	-0.745** [0.353]
Exposure to non-parental care × High SES	-0.691** [0.275]	-0.317 [0.291]	-0.175 [0.309]	-0.783*** [0.291]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14
Panel B				
Exposure to centre-based care × Low SES	-1.146 [0.723]	-0.617 [0.676]	-0.986 [0.699]	-0.6 [0.645]
Exposure to centre-based care × Mid SES	-0.394 [0.383]	-0.405 [0.443]	0.127 [0.407]	-0.436 [0.437]
Exposure to centre-based care × High SES	-0.482 [0.395]	-0.088 [0.405]	-0.152 [0.409]	-0.642 [0.395]
Exposure to family day care × Low SES	0.307 [0.912]	1.403 [0.986]	-0.951 [1.061]	0.127 [0.912]
Exposure to family day care × Mid SES	-1.025 [0.690]	0.237 [0.745]	-0.376 [0.615]	-1.803*** [0.656]
Exposure to family day care × High SES	-1.511** [0.740]	-0.592 [0.743]	-1.582** [0.750]	-0.606 [0.760]
Exposure to informal care × Low SES	0.301 [0.811]	0.444 [0.952]	-0.14 [1.136]	0.208 [1.015]
Exposure to informal care × Mid SES	0.036 [0.696]	0.353 [0.539]	0.423 [0.575]	-0.701 [0.574]
Exposure to informal care × High SES	-0.934** [0.446]	-0.725* [0.430]	-0.099 [0.538]	-0.908** [0.451]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

Another important dimension of heterogeneity is in the quality of non-parental care. The LSAC dataset contains a number of proxies for the quality of non-parental care. We test four

of these: carer/child ratios, the share of staff with an early childhood qualification, whether the centre has been formally accredited, and a composite measure of quality (based on inspection by the National Childcare Accreditation Council). These measures are described in more detail in the Data Appendix. For simplicity, we focus on the same measure of non-parental care: exposure to non-parental care over the previous 2 years.

Table 10 presents the results from the ratios interaction. As in many of the specifications shown above, the coefficients on non-parental care are negative, though not always statistically significant. The carer/child ratio has a mean of 0.28 (implying an average group size of around 4). The interaction terms generally go in the expected direction, with coefficients on the carer/child ratio being mostly positive (implying that children have fewer behavioural troubles if there are more adults per child). Although most are not statistically significant, an exception is the composite index specification in Panel A, where the coefficient is -0.876 on exposure to non-parental care, and 1.467 on the interaction between exposure and the carer/child ratio. This implies that non-parental care has a negative impact on the composite index, except when the carer/child ratio rises above 0.59 (six carers for every ten children).

Table 10: Exposure to non-parental care over the previous 2 years, interacted with carer/child ratio

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Exposure to non-parental care	-0.876*** [0.299]	-0.245 [0.303]	-0.388 [0.301]	-0.999*** [0.351]
Exposure to non-parental care × Carer/child ratio	1.467** [0.703]	0.405 [0.733]	1.126 [0.714]	1.228 [0.966]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14
Panel B				
Exposure to centre-based care	-1.146** [0.451]	-0.819* [0.447]	-0.205 [0.469]	-1.122** [0.522]
Exposure to family day care	-2.003 [1.257]	0.612 [1.465]	-1.681 [1.335]	-2.648* [1.555]
Exposure to informal care	-0.449 [0.381]	-0.187 [0.333]	0.109 [0.378]	-0.761** [0.342]
Exposure to centre-based care × Carer/child ratio	2.778* [1.670]	2.497 [1.659]	0.094 [1.902]	2.648 [1.921]
Exposure to family day care × Carer/child ratio	3.416 [3.885]	-1.514 [4.517]	2.29 [3.969]	5.542 [4.574]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. Since information on carer/child ratios is unavailable for informal care users, it is set to zero in Panel A, and the *Exposure to informal care × Carer/child ratio* interaction term is not included in the specification shown in Panel B.

In Table 11, we repeat the exercise, but this time interacting with the share of staff who have early childhood qualifications (the average child is at a centre where 61 percent of the carers have early childhood qualifications). Here, we observe virtually no systematic pattern, regardless of whether we look at all non-parental care together (Panel A), or look separately at the impact of staff qualifications in centre-based care and family day care (Panel B).

Table 11: Exposure to non-parental care over the previous 2 years, interacted with share of staff who have early childhood qualifications

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Panel A				
Exposure to non-parental care	-0.373 [0.265]	-0.13 [0.255]	0.021 [0.268]	-0.579** [0.260]
Exposure to non-parental care × Share of staff with EC quals	-0.218 [0.565]	0.031 [0.555]	-0.255 [0.607]	-0.177 [0.614]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.13	0.14
Panel B				
Exposure to centre-based care	-0.365 [0.387]	-0.067 [0.398]	-0.17 [0.388]	-0.446 [0.360]
Exposure to family day care	-0.878 [0.606]	-0.304 [0.627]	-0.653 [0.597]	-0.686 [0.584]
Exposure to informal care	-0.392 [0.378]	-0.151 [0.330]	0.12 [0.376]	-0.699** [0.342]
Exposure to centre-based care × Share of staff with EC quals	-0.6 [0.857]	-0.677 [0.866]	-0.061 [0.909]	-0.357 [0.886]
Exposure to family day care × Share of staff with EC quals	-0.255 [1.754]	2.053 [1.782]	-1.446 [1.856]	-1.054 [1.970]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. In cases where the share of staff with early childhood qualifications is missing, it is set to zero.

In Table 12, we repeat the exercise, but this time interacting with the centre's accreditation status. (Since the assessment process was done separately for centre-based care and family day care, we do not show a pooled analysis here.) On average, 6 percent of children attend a non-accredited centre, and one of the purposes of the accreditation regime has been the belief that children's outcomes are better in accredited child care centres. None of the interaction terms in Table 12 are statistically significant, providing little evidence to support this view. Children's behavioural outcomes seem to be similar in accredited and non-accredited centres.

Table 12: Exposure to non-parental care over the previous 2 years, interacted with accreditation status

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Exposure to centre-based care	-0.088 [0.550]	-0.294 [0.612]	0.301 [0.616]	-0.163 [0.564]
Exposure to family day care	-0.086 [0.982]	0.921 [0.841]	-0.283 [1.071]	-0.765 [0.905]
Exposure to informal care	-0.398 [0.378]	-0.148 [0.330]	0.111 [0.375]	-0.706** [0.342]
Exposure to centre-based care × Accredited centre	-0.536 [0.581]	0.026 [0.638]	-0.569 [0.646]	-0.46 [0.597]
Exposure to family day care × Accredited centre	-1.126 [1.079]	-1.033 [0.981]	-0.91 [1.154]	-0.193 [1.025]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. In cases where the centre's accreditation status is missing, it is set to zero.

The final quality interaction uses a composite metric of centre quality, derived from expert reports. The results of this analysis are shown in Table 13. As with most of the other quality metrics, we find little evidence that children do better in centres that are judged by experts to be of higher quality. (Again, since the assessment process was done separately for centre-based care and family day care, we do not show a pooled analysis here.) These results differ from Loeb, Fuller, Kagan, and Carrol (2004), who find that children exhibit fewer behavioural problems if they attend centres where the caregivers receive higher ratings from experts. This difference might reflect the fact that our measures of centre quality capture not only carer-child interactions, but also other aspects of care provided at the centre.

Table 13: Exposure to non-parental care over the previous 2 years, interacted with quality rating

Dependent variable:	Composite index	Approachability index	Persistence index	Reactivity index
Exposure to centre-based care	-0.347 [0.275]	-0.176 [0.291]	0.002 [0.279]	-0.468 [0.285]
Exposure to family day care	-1.017** [0.454]	0.098 [0.469]	-1.052** [0.447]	-0.932** [0.455]
Exposure to informal care	-0.386 [0.381]	-0.143 [0.330]	0.119 [0.377]	-0.695** [0.343]
Exposure to centre-based care × Quality assessment	-0.118 [0.096]	-0.064 [0.114]	-0.011 [0.098]	-0.145 [0.136]
Exposure to family day care × Quality assessment	-0.191 [0.206]	-0.168 [0.239]	-0.174 [0.217]	-0.002 [0.236]
Observations	2648	2653	2657	2653
R-squared	0.18	0.13	0.14	0.14

Source: Authors' calculations, based upon data from the 2004 and 2006 waves of the birth cohort of the Longitudinal Survey of Australian Children.

Notes: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age², education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged temperament score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. In cases where the quality assessment is missing, it is set to zero. The analysis also includes an indicator variable to denote whether the centre was assessed under the new quality rating regime, which came into effect part-way through the LSAC study.

6. Conclusion

The debate over the impact of non-parental care on children is one that has attracted the attention of sociologists, psychologists and economists alike. But for many parents, the impact of paid child care is more than an esoteric academic debate. With the large-scale entry of women into the paid labour force, the use of non-parental care has inevitably risen. As a consequence, many parents feel guilty about their choice to use non-parental care.

Our results can potentially shed some light on this question. Controlling for a large number of child, parental and household variables, we observe a negative association between the reactivity index and non-parental care, and between the composite index and non-parental care. This result is significant when we define care as full-time current care, and as exposure over the previous two years. However, the magnitude of the relationship is quite small, and could be due to selection on unobservables if the degree of unobservables bias were as large

as the degree of selection on observables. Matched estimates and IV estimates generally point in the same direction, but are mostly statistically insignificant. Across SES groups, the negative association between outcome indices and non-parental care is largest among high-SES households. We find that the negative association is mitigated for children who attend centres with higher carer/child ratios. However, we find little evidence that other centre quality attributes (accreditation status, the share of qualified staff, and expert ratings) affect the correlation between non-parental care and children's behavioural outcomes.

Appendix Table 1: Summary Statistics

	Mean	Standard deviation
Composite index	0.044	0.996
Approachability index	0.025	0.992
Persistence index	0.039	0.985
Reactivity index	0.019	0.996
Currently using any non-parental care	0.732	0.443
Currently using centre-based care	0.556	0.497
Currently using family day care	0.082	0.275
Currently using informal care	0.263	0.441
Currently using full-time non-parental care	0.237	0.425
Currently using full-time centre-based care	0.153	0.36
Currently using full-time family day care	0.027	0.163
Currently using full-time informal care	0.063	0.244
Exposure to non-parental care	0.073	0.094
Exposure to centre-based care	0.041	0.068
Exposure to family day care	0.009	0.035
Exposure to informal care	0.029	0.059

Note: These summary statistics are for the sample used in the first column of Table 1. See text and Data Appendix for more details on variable definitions.

Data Appendix

A1: Coding Exposure to Non-Parental Care

The LSAC contains information on the current child care arrangement and the first child care arrangement in the child's life. The question about the current arrangement was: 'Over the past one month, has the child been looked after at regular times during the week by anyone other than you?' The question about the first child care arrangement was: 'Has the baby ever been cared for in the past on a regular basis by someone other than you (before any present care arrangements)?' The duration of usage is known for the current childcare arrangement, and the starting date is known for the past care arrangement. Based on these pieces of information, we created the exposure variables as follows:

- If a child does not use any non-parental childcare currently and has never been cared for under a non-parental childcare arrangement in the past, we set exposure to zero.
- If the current arrangement is non-parental care and this is the first non-parental care arrangement, then we code exposure as the number of days the child has attended that care, divided by the child's age (in days).
- If the current arrangement is non-parental care and the child was in another non-parental care arrangement previously, we do not know when the first arrangement ended. So we assume that there were no gaps between the arrangements, and calculate exposure as the number of days since the start of the first care arrangement, divided by the child's age (in days).
- If the child does not currently use non-parental care, but used non-parental care in the past, we assume that the duration of the first care arrangement was the same as the mean duration for the previous group (i.e., until the beginning of the current care).
- All exposure measures are adjusted for the number of hours per week, with a maximum of 99 (which was the maximum of the weekly hours of non-parental care). For example, if a child has been in continuous non-parental care since birth, for an average of 25 hours per week, the exposure measure is 0.25. Similarly, if a child has been in non-parental care for one-quarter of his or her life, but for 99 hours per week, the exposure measure is also 0.25.

A2: Carer/child ratio

The number of children is taken from 'the number of children usually present in the same room when he/she is at the arrangement.' The number of carers is taken from 'the number of adults usually with the child when he/she is at the arrangement.' The ratio is created by dividing the former by the latter. Possible answers for the number of children were 1-5, 6-10, 11-20, 21-30, or 31+. We coded these as 3, 8, 15.5, 25.5, and 35.5, respectively (the 31+ category was chosen by only one household in 2004, and 5 in 2006). Possible answers for the number of carers were 1, 2, 3, 4, or 5+. We coded 5+ as 5 (the category 5+ was chosen by 28 households in 2004 and 98 households in 2006).

A3: Share of staff with an early childhood qualification

The LSAC team combines the survey data with information on the formal care provider from the National Childcare Accreditation Council (NCAC). One of the pieces of information that NCAC collects is staff qualifications. For each formal care provider, we calculated the share of staff holding an early childhood qualification.

A3: Accreditation status and quality rankings⁶

The NCAC information included in the LSAC data also contains a child care provider's accreditation status and the Quality Profile ratings which were used by the NCAC to determine this status. Using Principal Component Analysis, we collapsed these ratings into a single quality rating for each care provider. The following describes the quality assessment process.

Childcare providers in Australia are regulated under the federal government's Child Care Quality Assurance (CCQA) system. Under this system, providers must satisfy a set of standards to be accredited. The standards cover areas such as staff relationships with children and peers, partnerships with families, learning environments, safety, nutrition and health, and management practices (NCAC, 2006a). Though accreditation is not mandatory, providers generally opt to have it because accreditation is linked to eligibility for federal subsidies, allowing providers to offer reduced fees.

Once registered, a provider must submit a self-evaluation report, called a Self-Study Report (SSR), within one and half years. The assessment process then involves a further survey (Validation Survey, VS) filled in by the director, staff and families prior to a visit from Validators who assess the provider with a Validation Report (VR). The providers may comment on the validation visit. These materials are then assessed by Moderators. Ratings from the SSR, VS, VR, and Moderator's evaluation are entered into a computer which calculates a composite Quality Profile of the provider. This indicates whether their practice is unsatisfactory, satisfactory, of a good quality or of an high quality. The National Childcare Accreditation Council (NCAC) accredits a provider if it achieves a rating of satisfactory or higher on all areas of assessment.

A provider cannot be accredited if it has not undertaken the necessary actions required in the assessment process (Non-Compliant); has not met the standards required under the system (Non-Accredited) or has serious problems related to licensing or child protection, as confirmed by relevant authorities (Accreditation Withdrawn). Non-compliant status, Accreditation Withdrawn status and a repeated or particularly problematic Non-Accredited status are reported to the Department of Families, Housing, Community Services and Indigenous Affairs which can suspend or cancel the provider's approval for subsidy purposes. Providers can apply for a lighter form of sanction, known as "additional conditions for approval".

⁶ The information in this Appendix is based on NCAC (2006a).

A4: Reasons for not using childcare

If parents did not report any current childcare arrangement, the LSAC asked the reason for not using any childcare. The answers included (1) child does not need it, (2) parent is available, other care not needed, (3) problems with getting child care places, (4) not available locally, (5) unsuitable location for work, (6) unsuitable location for home, (7) transport problems, (8) can't afford it – cost too high, (9) concerned with quality of care, (10) child has disability or special needs, (11) does not suit culture or ethnic beliefs, (12) does not want child cared for by strangers, (13) others. While parents who answered (1) and (2) clearly do not need non-parental childcare (and are thus not very comparable to child care users), parents who answered (3) are likely to have similar needs, yet just unable to obtain a slot. We use these households as a comparison group in one of the specifications.

References

- Altonji, J.G., Elder, T.E. and Taber, C.R. (2005), 'Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools', *Journal of Political Economy*, **113**, 151–184.
- Baker, Michael, Jonathan Gruber and Kevin Milligan (2008). "Universal Childcare, Maternal Labor Supply and Family Well-being," *Journal of Political Economy*, 116(4): 709-745.
- Bianchi, Suzanne M. and John P. Robinson. 1997. "What Did You Do Today? Children's Use of Time, Family Composition, and the Acquisition of Social Capital." *Journal of Marriage and the Family*, 59, 2, 332-344.
- Blanden, Jo, Paul Gregg, Lindsey Macmillan (2007) "Accounting for Intergenerational Income Persistence: Noncognitive Skills, Ability and Education.," *Economic Journal*, 117(519), C43-60.
- Blau, David and Janet Currie (2004). "Preschool, Day Care, and Afterschool Care: Who's Minding the Kids.," *NBER Working Paper* 10670.
- Duncan, Greg J. and Christina M. Gibson-Davis. 2006. Connecting Child Care Quality to Child Outcomes: Drawing Policy Lessons from Nonexperimental Data, *Evaluation Review* 30: 611-630.
- Education, Employment and Workplace Relations References Committee. 2009. *Provision of Childcare*. Australian Senate, Canberra.
- Evans, Gary W. 2004. The Environment of Childhood Poverty. *American Psychologist*. 59(2): 77-92.
- Guryan, Jon, Erik Hurst, and Melissa Kearney. 2008. "Parental Education and Parental Time With Children," *Journal of Economic Perspectives*, 22(3): 23-46.
- Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore: Brookes.
- Heckman, James and Yona Rubinstein (2001) "The Importance of Noncognitive Skills: Lessons from the GED Testing Program," *American Economic Review*, 91(2) 145-49.
- Herbst, Chris, M. and Erdal Tekin (2008) "Child Care Subsidies and Child Development," *NBER Working Paper* 14474.
- Hill, Jennifer, Jane Waldfogel and Jeanne Brooks-Gunn (2002) "Differential Effects of High-Quality Child Care," *Journal of Policy Analysis and Management*, 21(4), 601-627.
- Lee, V.E., J. Brooks-Gunn, E. Schnur, and F.R. Liaw (1990) Are Head Start Effects Sustained? A Longitudinal Follow-up Comparison of Disadvantaged Children Attending Head Start, No Preschool, and Other Preschool Programs, *Child Development*, 61, 495-507.

Loeb, Susanna, Margaret Bridges, Daphna Bassok, Bruce Fuller, Russell W. Rumberger (2007). "How Much is Too Much? The Influence of Preschool Centers on Children's Social and Cognitive Development," *Economics of Education Review*, 26, 52-66.

Loeb, Susanna, Bruce Fuller, Sharon Lynn Kagan, and Bidemi Carrol (2004). "Child Care in Poor Communities: Early Learning Effects of Type, Quality, and Stability," *Child Development*, 75(1), 47-65.

Magnuson, Kathrine, A., Christopher J. Ruhm, and Jane Waldfogel (2004). "Does Prekindergarten Improve School Preparation and Performance?" *NBER Working Paper* 10452.

National Childcare Accreditation Council (2006a), *Quality Improvement and Accreditation System Handbook*, 4th ed. NCAC: Surry Hills, NSW

National Childcare Accreditation Council (2006b), *History of the National Childcare Accreditation Council*. NCAC: Surry Hills, NSW

National Institute of Child Health and Human Development Early Child Care Research Network, and G. J. Duncan. 2003. Modeling the impacts of child care quality on children's preschool cognitive development. *Child Development* 74:1454-75.

Yamauchi, Chikako. 2010. "Parental Investment in Children: Differential Pathways of Parental Education and Mental Health" *Economic Record*, forthcoming