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The Effect of Child Care Centre Openings on Child Care Arrangements and Maternal Labour Supply

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Abstract:
This study investigates how new child care centre openings affect child care arrangements and maternal labour supply. The results show that centre openings induce a substitution toward centre-based care, away from home-based and informal care. This is accompanied by reductions in overall non-parental care usage and mothers' work, suggesting an increase in maternal care duties associated with the shift toward centre-based care. These results imply that, unlike the introduction of subsidised childcare, increasing centre availability only is likely to have a limited impact on maternal labour supply. While it may broaden childcare options, it is likely to disproportionately benefit relatively educated mothers, who demonstrate a particularly strong response. These findings are not driven by endogenous household migration, and are unlikely to be solely caused by endogenous centre entry.

JEL Codes: J13, J22
Key words: child care, labour supply, centre

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1. Introduction

Recently, there has been growing concern regarding the limited accessibility of non-parental child care as a possible constraint to maternal labour supply and early childhood education (OECD, 2006). This issue has become increasingly important as the expectation grows for governments to help women balance their work and family commitments. Such an expectation is particularly strong in aging societies where mothers are seen as potential contributors to social security funding. In addition, growing interest in early childhood education is likely to amplify demand for high-quality child care. In turn, this is likely to make concerns about availability more serious for centre-based care, which tends to be provided by more highly qualified staff than home-based care.

This paper examines how the opening of new child care centres influence child care arrangements and maternal labour supply. Specifically, I utilise the rapid increase in the number of centre-based child care places offered in Australia in the early 2000s. The number of places grew at the rate of 18% between 2001 and 2004, contributing more than 35,000 places. Exploiting the variations in the numbers of child care places offered across communities over a period of time, I examine the effect of the number of places per 10 children aged 0-4 years in a community on the behaviour of households in the community. In order to take into account the possibly endogenous geographic distribution of households, I analyse results by migration status. In addition, I shed light on the possibility of endogenous centre entry, by investigating the pattern of centre entry across communities with different socio-economic characteristics.

Results show that centre openings induce substitution toward centre-based care, away from home-based and informal care. An additional centre-based child care place per 10 children induces relatively educated mothers with 0-2-year-olds to increase the probability of using centre-based care by 14 percentage points, while reducing the probability of using home-based care by 16 percentage points. These changes amount to 62% and 121% of the respective average probability for these mothers during 2002-2004. Overall, centre openings reduce total weekly non-parental care time per child by 2 hours, and maternal work time by 3.5 hours, suggesting increased parental care duties. Evidence suggests these findings are not driven by households' selective migration, and centres are unlikely to know of or use unobserved factors affecting these outcomes in deciding the location of operation.

These results have important implications for public efforts to ensure accessibility of child care.[2] They imply that an increase in child care centres is likely to have a limited impact on maternal workforce participation. While it is likely to broaden child care options, the concentrated take-up suggests that increased centre availability is likely to disproportionately benefit relatively educated mothers.[3]

Some of these findings are in contrast with the previous studies on the impact of subsidised child care/preschool. The recent study by Baker, Gruber and Milligan (2008) examines the effect of the subsidised child care system for 0-4-year-olds,

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[2] For example, some governments let the market provide services with a minimum standard set by regulation, and encourage providers to operate in areas with limited supply by offering start-up assistance. Other governments directly provide free or low-cost childcare, managing the geographic allocation of care facilities (OECD, 2002, 2003, 2004, 2005, and 2007).

[3] Consideration of childcare policy formulation necessitates knowledge of the impact on parents' behaviour and children's well-being, and it could be that the benefit from the effect of childcare availability on children's outcomes is overwhelming. Since the data used in this study do not provide information on the latter, this paper focuses on parental, particularly maternal, labour supply and childcare utilisation.

introduced in the Canadian province of Quebec. The study indicates that, following

the introduction of subsidised child care, compared to the rest of the country, Quebec

exhibited an increase in overall usage of child care among married mothers by 15

percentage points, one-third of which was due to a shift away from non-subsidised

care toward subsidised care. While this substitution effect is similar to the substitution

toward centre-based care induced by centre openings, the study also identifies an

increase in married mothers' labour force participation by 8 percentage points.

A similar substitution effect is found for the U.S., but the evidence on the labour

supply effect is more mixed. Utilising the staggered introduction across the US states

of preschool for 5-year-olds into the public school system, Cascio (2006) shows that

the initiative increased utilisation of public subsidised schools by 11-24 percentage

points. About half of this increase was due to overcrowding of private, unsubsidised

preschools. While take-up was observed widely, no labour supply effect was found

for married mothers in her study. On the other hand, using the 1980 US census,

Gelback (2002) finds a positive effect on labour supply for married mothers of 5-year-

olds eligible for free preschool service, compared to mothers of 5-year-olds who were

not yet eligible for it.[4]

Evidence of the positive effect on maternal labour supply has also been observed in

other countries that introduced public preschool for somewhat younger children.

Schlosser (2005) examines Israel's recent attempt to provide new preschools for Arab

3-4-year-olds between 1999 and 2003, which increased their attendance by 60

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[4] Results for married mothers are more relevant for this paper, as the study's sample of single mothers is too small to provide robust evidence. Baker et al. (2008) also focus on married mothers. Both Cascio (2006) and Gelbach (2002) find that single mothers who do not have children younger than five show an increase in labour force participation. Finally, Blau and Tekin (2007) reported the positive effect of subsidy receipt on labour supply of single mothers with 0–12-year-olds.

percentage points. She shows that labour force participation of Arab mothers in towns designated for provision of new preschools increased by 7-12 percentage points, compared to towns in the control group.

In addition, Berlinski and Galiani (2006) find that, in Argentina, regions with an additional increase in the number of public preschool places per child exhibited an increase of 89 percentage points in the probability of attendance among 3-5-year-olds, and a 7-14 percentage point increase in the probability of mothers participating in the labour force. These two studies do not investigate substitution between different types of preschool. The high attendance effect may suggest there were few unsubsidised alternatives.[5]

The present research departs from the abovementioned previous studies in that it focuses on the effect of increased centre availability in a setting where no change has been introduced to the subsidy system. While there is a significant body of evidence regarding the impact of a subsidised child care system, the effect of facility availability *per se* has not been fully investigated. However, it has been shown the availability of educational facilities can affect attendance (e.g., Card (1995), Currie and Moretti (2003) and Duflo (2001)). The differences between my results and the results based on the previous studies also facilitate our understanding of the mechanism through which the subsidised child care/preschool system works. Since a

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[5] Earlier studies also investigated the effect of childcare cost on utilisation and maternal labour supply, chiefly based on a cross-sectional, structural-estimation approach. Most likely reflecting the lack of an exogenous variation in the cost of childcare, they provided more mixed evidence. Studies using a relatively exogenous variation suggest the small but positive effect on utilisation and mothers' labour supply. These studies are reviewed by, for example, Anderson and Levine (2000), Blau (2003), Blau and Currie (2004), and Baker et al. (2005). Existing evidence for Australia is also based on cross-section analysis, and the price elasticity is estimated to be positive, but smaller than the range reported in other countries (Doiron and Kalb, 2005, Kalb and Lee, 2008, Rammohan and Whelan, 2005, 2007).

public child care/preschool system usually provides households with not only increased availability but also reduced fees, the absence of the positive effect of centre openings on overall child care usage or maternal labour supply found in this study suggests the fee-reduction component embedded in the subsidised child care system is likely to be the key factor in the positive effect on these outcomes. On the other hand, the substitution toward centre-based care induced by the increased availability of that care is akin to the substitution away from unsubsidised preschool/child care (Baker et al, 2008, Cascio, 2006).[6]

The present research contributes to the international comparison of different child care regimes. While there is growing interest in subsidised child care centres and preschools, critics argue that such a scheme necessitates a substantial tax burden and organised local government service. Countries that are unlikely to meet these requirements may find it more suitable to pursue a mixture of market child care provision and public provision of more targeted subsidies and quality assurance (OECD, 2007). Since the beginning of the 1990s Australia has pursued this combination of state and market approach, during which time the supply of child care has expanded mainly due to growth in the private sector (OECD, 2002; Press and Haynes, 2000). This paper provides evidence of the effect of this market-driven supply of child care, together with the pattern of child care centre entry into different communities.[7]

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[6] Based on the regional variation in the quality-adjusted fee level, Blau and Hagy (1998) also find substitution away from more expensive types of care.
[7] Blau (1993, 2001) investigated the supply of childcare focusing on labour supplied by childcare workers. The relationship between community characteristics and centre entry has not been studied. Another set of studies focuses on the rationing of supply in settings where childcare is mainly publicly provided (Gustafsson and Stafford, 1992 and Del Boca and Del Vuri, 2007). These studies, however, examine whether price responsiveness differs in rationed areas and areas with enough supply of public childcare, without directly testing the impact of availability. Based on the cross-section data from

The remainder of this paper is presented as follows: in Sections 2 and 3, I describe the data used in this study and child care institutions in Australia. In Sections 4 and 5, the conceptual framework and identification strategy are discussed. Sections 6 presents the results and conclusions are drawn in Section 7.

2. Data

This study utilised the 2002-2004 Household Income and Labour Dynamics in Australia (HILDA) Survey, which constitutes nationally representative longitudinal household data collected since 2001. The 2002-2004 panels are used in this paper because the questionnaire on child care usage significantly changed in 2002, and the Australian child care policy framework changed after 2004.[8] Mothers of at least one child aged 0-4 years[9] are extracted from each wave. When pooled together, they comprise three cohorts of mothers with young children.

This household (mother)-level data is merged with the information on community-level information based on the area of each household's residence. A community is defined by Statistical Local Area (SLA), which contains one or more Census Collection Districts.[10] The summary statistics of household- and community-level variables are depicted in Table 1 (See Appendix 1 for details).

Germany, where hardly any private providers operate, Kreyenfeld and Hank (2000) find no relationship between the availability of care and mothers' labour supply.

[8] A new program, the Child Care Tax Rebate, was introduced in 2005, which is likely to reduce out-of-pocket childcare expenditure for middle- and high-income households. In order to focus on the effect of centre openings, I study the period in which the policy framework remains unchanged.

[9] Mandatory education starts from the age of six. Five-year-olds who turn six during an academic year therefore begin attending primary school.

[10] As of 2001, there were 1353 SLAs, which contained 37,209 Census District (CD)s in Australia. An urban CD had about 220 dwellings, while the number for rural CD depended on population density (Australian Bureau of Statistics, 2001).

3. Child care Institutions in Australia

3.1 Types of Child care

The major, formal pre primary-school facilities can be categorised into two groups: centre-based care and home-based care. Centre-based care includes Long Day Care (LDC) and Kindergarten/Preschool. LDC is a centre-based form of child care service and typically looks after children who have not yet started school. Staff members are more likely to have qualifications in early childhood education or child care, compared to home-based caregivers.[11] While kindergartens and preschools are administratively categorised as educational as opposed to child care facilities,[12] they both provide the same service in terms of freeing up mothers' time for work or other activities. Further, kindergarten or preschool services are sometimes offered at child care facilities, and some preschools offer a child care service as well. Home-based care (the second type of formal child care) includes Family Day Care (FDC), which is provided by registered carers at their homes or the child's home.[13] In addition to these two types of formal service, informal care is provided by grandparents, relatives, friends, neighbours, and unregulated nannies.

Between 2002 and 2004, an average of 58% of households used some type of non-parental care for at least one hour per week. Centre-based care was used by 30% of households, while home-based and informal care was used by 14% and 38% of

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[11] For example, 61% of 52,865 Long Day Care staff hold a qualification, while 31% of 10,669 Family Day Care carers hold one (Department of Education, Employment and Workplace Relations, 2006).

[12] One year before primary school, children who turn five can attend kindergarten, which operates five days a week. Two years before primary education, children who turn four can go to preschool, which provides about 10-12 hours of preparatory classes over two or three days a week. These pre-primary-school services have different names in each state. For example, the program one year before primary school is termed kindergarten in New South Wales (NSW) and the Australian Capital Territory (ACT), while it is termed preschool in Queensland. The program two years before primary school is called preschool in NSW and ACT, and kindergarten in Queensland.

[13] The description of LDC and FDC is based on the Department of Family and Community Services (2005).

households, respectively (Table 1).[14] The proportion of households using some form of non-parental care exceeds the proportion of households in which mothers work (51%), suggesting that some households use non-parental care for purposes unrelated to maternal work. The average user of non-parental child care uses it for 17 hours per week. Among formal care users, the figure is somewhat lower for centre-based care users (16 hours) than home-based care users (18 hours). This may partly reflect the fact that centre-based care users face a more rigid time schedule set by centres.

3.2 Measure of centre-based child care availability

The availability of centre-based child care is measured by the estimated number of places available at centre-based providers per 10 children aged 0-4 years. First, the information on the number of child care centres was collected for each community. This number was then multiplied by the state-level average number of child care places per centre. The resulting figure was then divided by the number of children aged 0-4 in the area, and multiplied by 10.[15]

Some of these places were provided by private (for-profit) centres, while others were provided by community-based (not-for-profit) centres.[16] Although the data source does not allow the disaggregation of centres based on management structure, the

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[14] Usage of different types of care is not mutually exclusive; one household can use multiple types of care for at least one hour each.

[15] See Appendix 1 for details. Since the number of childcare places per centre does not vary within state and year, the measure used in this paper under- (over-)estimates the number of places per 10 children in an area with an above- (below-) average number of children per centre. However, to the extent that this non-classical measurement error is time-invariant, it is differenced out in the fixed effects estimation. This is true if a new centre in a certain area is a similar size to existing centres in the area. This is likely the case, as population size, an indicator for demand size, did not change drastically within three years of the analysis period. The measure also does not capture a change in the maximum number of children existing centres accommodate. However, conversations with some centre managers suggest the scope for this adjustment could be small because of limitations of space and staff to match the increased number of children.

[16] Community-based providers are owned by not-for-profit entities such as local governments, community/religious organisations, charities and non-profit organisations (Australian Institute of Health and Welfare (AIHW), 2007; the Department of Family and Community Services, 2004).

variation during this period was dominated by the increase in supply from the private sector. Between 2001 and 2004, the growth rate of the total number of centre-based child care places was 24% for the private sector, and 7% for community-based providers.[17]

In the sample, between 2002 and 2004, on average 3.3 places were available per 10 pre school-aged children. Over the two-year period, the number increased by 0.3 (11 %) from 3.1 to 3.4. The linear and non-parametric relationship between centre openings and the average weekly time spent in child care indicates that communities with a greater increase in centre availability exhibit a greater increase in the use of centre-based care (Figure 1, Left Panel), and a greater decrease in the use of home-based child care (Figure 1, Right Panel). These figures demonstrate the key variations in the data. The econometric analysis below explores the robustness of these observations from various perspectives.

3.3 Child care Policy Framework

As this paper focuses on centre openings and their impact on household behaviour, it is important to note the child care policy environment did not change during the analysis period. The major child care policy at the federal level, which accounts for a large proportion of public expenditure on children's services, did not change between 2002 and 2004.[18] The policy consisted of a price subsidy, quality assurance, and direct support for providers, the details of which are provided in Appendix 2. The only change during the period was the repeal of the state regulation on licensing in two of

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[17] The share of childcare places provided by the private sector rose from 68 percent (of the total of 193,809 in 2001) to 72 percetn (of the total of 229,603 in 2004) (AIHW, 2005).

[18] For example, in the 2006/07 fiscal year, the Australian Government accounted for 78% of total government expenditure on children's services (A$3.03billion) (Steering Committee for the Review of Government Service Provision, 2008).

the seven states/territories.[19] In order to control for the possible effect of this change

as well as other common state-level changes, the regression analysis incorporates

heterogeneous year effects.[20] The source of variation explored in this paper is not

those arising from changes in the policy framework, but changes in centre availability

across communities over time. As these changes were the result of the providers'

location choice, the pattern of entry across communities with different characteristics

is explored.

4. Conceptual framework

The availability of child care can affect household decision-making about child care

usage and labour supply in various ways. Households located close to centres are

more likely to take advantage of newly available services because, first, they can

reduce the effective hourly price that parents need to pay by decreasing transportation

costs.[21] Second, an additional child care centre in the neighbourhood can increase the

marginal benefit of using centre-based care as perceived by parents. For example, a

nearby service may be utilised by neighbouring households, who can provide

information about the quality of care offered at the centre, reducing parents'

uncertainty. At the same time, information relating to the possible benefits of using

centre-based care, such as providing social interaction with peers and learning

opportunities, may become more widely shared among the local community.

Proximity to centres can also provide parents with the security that they can collect

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[19] The states of Queensland and New South Wales introduced new childcare regulations in 2003 and 2004, respectively. These state governments set regulations regarding the approval of premises, construction plans, applicants, and staff. For example, requirements are set based on the number of children in care, the size of rooms, the number of staff and their qualifications, and health/safety (Department of Family and Community Services, 2005).

[20] The state-specific year effect is included for the state of Victoria in addition to the two states that introduced new childcare regulations. The remaining four states and territories have too few observations to include their own year effects.

[21] For the formal model of maternal employment and childcare usage decisions, see Blau (2003).

their children in the event of an emergency. Third, the increased availability of child care can facilitate greater competition among providers, which may result in a reduction in the average fee level and an improvement in the average quality.

These factors are likely to induce parents to utilise centre-based care. This demand increase could be accompanied by a decrease in demand for other types of care. If overall usage of non-parental child care increases, it can increase maternal time that can be devoted for work. This paper does not aim to disentangle the various pathways through which child care availability may affect household decision making; rather, it provides evidence of the overall impact of new centre openings.

5. Empirical Strategy

To identify the correlation between centre openings and changes in the outcomes, I use the following community fixed effects model for cohorts of mothers with at least one 0-4 years:

$$Y_{ijst} = a + bN_{jt} + d_1X_{ijt} + d_2COM_{jt} + S_s*T_t + u_j + e_{ijst} \ (t = 2002\text{-}2004) \tag{1}$$

The outcome variable, Y_{ijst}, includes indicators of maternal labour supply and child care usage for a household i, living in community j in state s, in year t. The outcome is assumed to depend on the number of centre-based child care places per 10 children in the community in which the household lives, N_{jt}, controlling for community (SLA)-level unobserved effects, u_j, state-specific year effects, S_s*T_t, and time-variant household- and community-level characteristics, X_{ijt} and COM_{jt} (See Table 1). The parameter of interest, b, indicates how the behaviour of a cohort of mothers with 0-4-

year-olds differs compared to the previous cohort of mothers, particularly in communities where a new centre-based care place becomes available per 10 children in the area, netting out these controls. The error term is allowed to be correlated within the community across years. This difference-in-differences specification is comparable to recent studies (Baker et al., (2008), Cascio (2006) and Schlosser (2005)), and is similar in particular to the specification used by Berlinski and Galiani (2006).

To the extent that unobserved household preferences or unobserved determinants of centres' entry, which are correlated with both the centre availability and the outcome, are time-invariant, the parameter b shows the causal effect of the availability of centre-based care. However, if such unobserved factors are time-variant, then the estimates based on Eq.(1) may provide a biased estimate. I first discuss the results based on this baseline model, and then provide indirect evidence suggesting the main findings are not driven by this potential bias.

The sample is separated into subgroups based on marital status, educational attainment, and the child(ren)'s age. First, married and single mothers are likely to have different constraints in terms of available caregivers and income earners (Gelbach, 2002, Cascio, 2006). Since few effects have been accurately estimated for single mothers, mainly due to the small sample size, this study focuses on married mothers in particular. Second, married mothers are separated into those with relatively older children (3-4-year-olds) and those without them (therefore with 0-2-year-olds). This distinction is based on the fact that centre-based care is chiefly used by 3-4-year-olds, and the existence of younger children can hamper the possibility for mothers to

increase labour supply, even when older children start using non-parental care (Gelbach, 2002, Cascio, 2006, Schlosser, 2005). Third, married mothers are further divided into relatively educated and less educated mothers. There is significant heterogeneity in response to the introduction of subsidised preschool or the cost of child care by maternal educational attainment (Anderson and Levine, 2000, Schlosser, 2005). The pattern of child care usage and maternal labour supply differs in Australia as well (Fig.2). Educated mothers (those holding a qualification or a bachelor's degree or higher) are more likely to use non-parental care in general; and they are also more likely to use centre-based care.[22]

The unit of observation is a mother / household. This facilitates the comparison of the results for maternal labour supply and child care utilisation. For households with more than one child aged 0-4 (32% of the sample), usage is defined as using a certain type of care for at least one of their children for one hour; the number of child care hours is defined as the total time the children spend at a certain type of child care in a usual week, divided by the number of children.

6. Results

6.1 Basic results

The results of estimating Eq.(1) indicate that centre openings are correlated with substitution of home-based with centre-based care (Table 2). The estimates for the whole sample (Row A) indicate that an additional centre-based place per 10 children is associated with a four percentage-point decrease in married mothers' likelihood of using home-based care (Column 3) and a one-hour reduction in the weekly average

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[22] Less educated mothers are defined as high-school graduates and those who had not finished high school.

number of home-based child care time per child (including zeros) (Column 7). These reductions are accompanied by a one-hour increase in average weekly centre-based child care time per child (Column 6). Overall, married mothers' use of non-parental care is unchanged (Columns 1, 5, and 10). One explanation for these results is that, as centre-based care became more readily available, the need to use a substitute, home-based care, decreased.

The results for educated mothers who do not have 3-4-year-olds (Row C) demonstrate a particularly strong shift toward centre-based care. An additional centre place per 10 children is correlated with a 15 percentage-point increase in their probability of using centre-based care, and a 14 percentage-point decrease in the probability of using home-based care. In addition, the probability of using informal care also indicates a nine percentage-point decline (Columns 2-4). The results also show the average amount of time children spent at centres increased by 2.6 hours per week, while the time they spent with home-based carers decreased by 4 hours per week (Columns 6 and 7). Combined together, the time for which children were looked after by non-parental carers slightly decreased, though not accurately estimated (Column 5). It is therefore unlikely that the substitution away from home-based care was related to the desire to reduce parental child care time. Other considerations such as benefits for children might have induced the shift toward centre-based care.

When mothers are separated out based on having 0-2-year-olds, rather than 3-4-year-olds, the results for mothers with younger children are consistent with the estimates in Row C, but weaker (not shown). That is, given that an educated mother has a 0-2-year-olds, if she also has a 3-4-year-old, then the correlation between their

behavioural change and centre openings is more limited. A possible explanation for this is that, when centres choose applicants, they generally place priority on children whose siblings are already under their care. Thus, mothers who have 3-4-year-olds are less likely to need to look for a new centre-based place for their 0-2-year-olds. In contrast, the behavioural changes among educated mothers who have 3-4 year olds are not associated with centre openings (Row D). This is consistent with the decision to send these children to centres or kindergarten already having been made when new centres opened.

The results for less educated mothers exhibit a similar substitution toward centre-based care; however, unlike the case for educated mothers, the shift is relatively concentrated among mothers with 3-4-year-olds (Row G). Also, the increase in centre-based care usage is found on the intensive margin, not on the extensive margin. An additional centre-based care place per 10 children is associated with a 9 percentage-point reduction in the probability of less educated mothers with 3-4-year-olds using home-based care (Column 3), while it is associated with a one- and 3.5-hour increase in the average weekly centre-based care time per child among all these mothers (Column 6) and among users of centre-based care (Column 12), respectively. The results also indicate that overall non-parental care usage did not change (Columns 1 and 5).

One possible reason for these differential results is that educated mothers move early on to secure a place for their children for the coming years. These mothers take advantage of centre openings, particularly if they have 0-2-year-olds who do not have

older siblings, which would ensure priority for a place at an existing centre. Once the 0-2-year-olds have a place, they are likely to keep that place until they start school.

However, the early move by educated mothers appears to come with reduced labour supply. The probability of working decreases by 11 percentage points and the average work time falls by 3.5 hours (Table 3, Row C). Few significant changes in maternal labour supply are found for other groups of married mothers. The negative effect on labour supplied by educated mothers without 3-4-year-olds however exceeds the reduction in non-parental care time. This suggests that a spurious factor may be at work in producing the negative effect on educated mothers' labour supply. One such factor is selective migration by mothers who plan to reduce their labour supply or increase the use of centre-based care, into communities where new centres are opening. The following section tests whether such selective migration drives the results observed in the baseline model estimates.

6.2 Selective migration

Unlike mothers who moved across communities during the analysis period (movers), those mothers who stayed in the same area (stayers) were not subject to the endogenous migration. The results of repeating the estimation depicted in Table 3 only for stayers reveal that selective migration explains the seemingly excessive decline in maternal labour force participation (Table 5). Once the sample is limited to stayers, the effect on the labour force participation rate is insignificant for educated mothers with no 3-4-year-olds (Row C). On the other hand, the effect on the intensive margin is consistently found (Column 2). These mothers exhibit a 3.7-hour reduction in the average amount of work time, associated with an additional centre-based place

per 10 children. These results provide an indication that increased centre availability may have had a negative effect on the intensive margin of maternal labour supply.

The results for usage suggest the substitution effect is unlikely to be generated solely by endogenous migration (Table 4). The results for stayers are consistent with the results for the whole sample, and if anything, they are more accurately estimated. For example, stayers consistently indicate a one-hour increase in weekly centre-based care time, together with a one-hour decrease in home-based care time, associated with an additional centre-based place per 10 children (Row A). Educated mothers who do not have 3-4-year-olds indicate greater responses to the increase in centre care availability (Row C): three more hours of centre-based care and five fewer hours of home-based care per week per child. The results also suggest that these mothers exhibit a 1.9-hour decrease in overall non-parental care time (Column 5). The reduction is even larger when the sample was limited to non-parental care users (Column 10).

One explanation consistent with this finding and the decline in the number of maternal work hours is that educated mothers adjust the intensive margin of labour supply, in order to accommodate increased care duties associated with the shift toward centre-based care. This may include the need to follow a strict time schedule specified by the centre. As discussed above, centre users leave children in care two fewer hours per week compared to home-based care users (Table 1). The rigid schedule set by centres may not be compatible with the mothers' work schedule.

It may appear these results are caused by other changes in the local area, such as changes in general economic conditions specific to communities that attract child care

centres. However, the following evidence suggests this is unlikely to be the case. First, one of the covariates, the unemployment rate, is likely to capture the effect of local economic conditions. In addition, when the 'effect' of centre openings on labour supply is examined for women of the same age range in the same communities, who have older or no children, no similar effect is found (Appendix Table). While these groups of women may not be directly comparable to mothers with small children, the results provide an indication for the absence of a bias due to area-specific unobserved changes correlated with centre openings. Another potential concern is selective entry by child care centres. That is, centres might open in communities with a growing proportion of mothers who plan to start using centre-based care, due to factors unobserved in data. The next section provides indirect evidence suggesting that this is also unlikely to be the case.

6.3 Selective entry by child care centres

If child care providers aim to maximise their profits in deciding where to open a new centre, they are likely to locate themselves in communities with lower input costs and a higher child care price.[23] If child care providers are also aware of the factors affecting household behaviour, which are not observed by researchers, and use this knowledge to determine the location of operation, the number of centre openings is likely to be correlated with indicators for household behaviour, observed at the time of the decision making. Based on this consideration, I examine the association between the number of centre openings and changes in a number of area-specific characteristics using the following community fixed effects model:

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[23] Not-for-profit childcare providers may also consider social welfare. However, the profit maximisation behaviour is likely to dominate the relationship between centre openings and changes in area characteristics observed in the data. This is because most new openings are supplied by private services, as discussed in section 3.2.

$$Y_{jt} = a + b_1 w_{jt-1} + b_2 r_{jt-1} + b_3 X_{jt-1} + v_j + u_{jt} \tag{2}$$

The outcome variable, Y_{jt}, is the number of child care centre openings in community j

in year t. This is assumed to depend on the past input costs: wage rate, w_{jt-1}, and rental

cost, r_{jt-1}. The cost factors in the past year are likely to be relevant because anecdotal

evidence suggests it takes on average of one and a half to three years to obtain a

licence and begin operating a centre.[24] In addition, the price of child care is proxied by

demographic and economic characteristics of residents, X_{jt-1}, which is likely to affect

demand for centre-based child care. This includes average household income,

population size, and shares of population by age group (See Table 6 for details).

While controlling for these cost and demand factors, as well as unobserved

community-level fixed effects, v_j, I investigate whether the past indicators of

household behaviour exhibit a correlation with centre openings, as follows:

$$Y_{jt} = a + b_1 w_{jt-1} + b_2 r_{jt-1} + b_3 X_{jt-1} + b_4 Z_{jt-1} + v_j + u_{jt} \tag{3}$$

In particular, the past maternal labour supply indicators were used for household

behaviour, Z_{jt-1}, while the past child care usage indicators were unavailable because

these were not consistently measured in the HILDA Survey in 2001.

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[24] Generally, a prospective owner of a centre needs to purchase/lease premises, obtain approval from a local council for the development of a centre in the premises, obtain approval from the state government for the centre's physical structure, manager, main carer, and service plan (Australian Capital Territory Government, 2000; New South Wales Department of Community Services, 2008; Northern Territory Government; Queensland Department of Communities, 2007; South Australia State Government, 2008; Tasmania Child Care Unit, 2003; Victoria Department of Education and Early Childhood Development, 2007; West Australia Government, 2007). Results based on covariates observed two years prior to centre openings are similar but weaker, most likely due to the smaller sample size.

The results suggest that centres take into account changes in input prices and demand factors. However, their openings are not significantly correlated with changes in past household behaviour (Table 7). Columns 1 and 3 show the results of estimating Eq.(2) using all the communities and communities covered by the HILDA Survey, respectively. The results in Column 3 suggest that communities that experienced a rise in the median retail property value between one year and the next were less likely to experience a centre opening between the next year and the year later. A similar relationship is found between an increase in the median residential property value and centre openings. The reason these results are found only in communities covered by the HILDA Survey may be that excluded communities, which are typically remote, are not a relevant potential site for child care centres. Also, the transaction of commercial property is correlated with future centre openings (Column 1). This suggests that communities that attract commercial offices in general are also likely to bring in child care centres. The relationship between the average past wage rate and centre openings is less clear. Communities with an increase in average wage earnings (a proxy for the wage rate) were less likely to experience centre openings (Column 1). However, when the hourly wage rate is used for the subsample in Column 3, no significant correlation emerged. This might be due to the fact that the wage rate for child care workers is highly regulated in Australia.

Demand-related area characteristics are also taken into account by centres. They are more likely to enter communities with rapid population growth, suggesting that centres choose communities with growing number of potential customers.[25] A change

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[25] Total population is interpolated based on the 2001 and 2006 Censuses. Thus, its growth does not change across years. Standard errors are computed allowing for serial correlation. Regressions also include the shares of the population aged 0–2, 3–4, 5–9, 10–19, and 20–49. The shares in Columns 1 and 2 are interpolated, while those in Columns 3 and 4 are the sample averages from the HILDA

in the median household income does not show a significant correlation with centre openings. This is due to the correlation between the median income and population size. The median income shows a positive correlation with centre openings when population size is excluded. However, growth in the proportion of educated adult population discouraged centres' entry. This may reflect cost factors that are not captured in the property values and wage rate.

Columns 2 and 4 indicate the results of estimating Eq.(3), which suggest that, once these cost and general demand factors were controlled, changes in the number of child care centres are not associated with changes in maternal labour supply, measured by the share of working mothers of 0-4-year-olds and their average work hours.[26] These results provide an indication that centres' location choice does not significantly depend on unobservable factors correlated with maternal labour supply. While not perfect, these results seem in turn to offer indirect support to suggest selective centre entry is unlikely to be the only factor producing the negative effect of centre openings on maternal labour supply, associated with the shift toward centre-based care usage.[27]

7. Conclusion

This study has investigated the impact of the local availability of child care centres on child care utilisation and maternal labour supply. In particular, it has exploited the

Survey. The latter are noisier, but provide a variation in growth across years. At any rate, both sets of controls indicate few associations with centre openings.

[26] The number of observations used in Columns 2 and 4 is small because the past maternal labour supply variables are available only for areas covered by the HILDA Survey, where at least one 0–4-year-old was found.

[27] Based on the results of the correlation between centre openings and input prices, non-residential property prices in particular, one may consider the instrumental variable method. However, the prices are likely to be correlated with unobserved factors affecting household behaviour. The results based on the identification strategy suggest a concentrated positive impact of centre openings on employment and centre-based care usage only for mothers who moved across areas. This suggests that mothers who plan to start working are more likely to move to areas with active non-residential property sales.

across-community variation in centre openings, controlling for community fixed effects. The major findings are that, first, centre openings induce a shift toward centre-based care, away from home-based and informal care. Second, this substitution of centres is accompanied by a reduction in total non-parental care time and maternal work by 2-4 hours a week. A possible explanation is that parental care duties increased due to the more strict time schedule set by centres. Unlike previous studies on subsidised child care, these findings imply that the increase in the availability of child care centres, with no substantial fee reduction, does not increase the total usage of non-parental care or maternal labour supply. Evidence suggests that this is not due to the selective migration by mothers, and centres' location choice is uncorrelated with household behaviour at the time of their planning.

These responses to centre openings are heterogeneous, which is most likely due to the early move by educated mothers. The substitution effect is concentrated among educated mothers with 0-2-year-olds (but not 3-4-year-olds) and less educated mothers with 3-4-year-olds. A potential reason for this is that educated mothers take advantage of new centres for their 0-2-year-olds. As this early move secures a place for the coming years, educated mothers with 3-4-year-olds exhibit no response to new centre openings. In contrast, less educated mothers tend to start looking for a centre-based child care place when their children are aged 3-4. Thus, the substitution effect is found among those with children of this age group.

These findings give rise to questions of why educated mothers show a strong response to new centres at the early stages of their children's lives. There are several possible pathways to generating the heterogeneous response. First, this difference may be due

to an income constraint. Between 2002 and 2004, the out-of-pocket expenditure was A$5.4 (US$4.1) per hour or A$77 (US$59) per week for centre users, while it was A$4.1 (US$3.1) per hour or $59 (US$45) per week for home-based care users.[28] Even though low-income families receive a more generous child care subsidy, the cost of centre-based care may still be a barrier for less educated mothers. In fact, when a subsidised preschool was introduced, increased attendance was found for children of both married and single mothers (who are likely to have different levels of disposable income) (Cascio, 2006). The contrast between the positive utilisation effect of subsidized preschool and the absence of such an effect of increased availability suggests the importance of out-of-pocket expense reduction for relatively disadvantaged households.

Second, educated parents may also have higher expectations of benefits for children arising from centre-based care, being more aware of the public discussion related to the following evidence. Previous studies examining small-scale randomised trials in the US demonstrate the positive effect of quality centre-based care (combined with comprehensive service, including home visit and nutritious snacks provision) on cognitive development of disadvantaged children. While evidence on other widely available programs is mixed, the observation is well reported that children attending preschools and child care centres indicate higher cognitive achievements.[29] In addition,

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[28] The values are in terms of 2005 prices. The US dollar values are based on the exchange rate of 0.7668 US cents per Australian dollar in January of 2005.
[29] Blau and Currie (2004) provide an excellent review. On the other hand, there is evidence for the negative effect of non-parental childcare exposure on children's behavioural problems, based on cross-sectional comparison (Magnuson, Ruhm and Waldfogel, 2004; Herbst and Tekin, 2008) and the difference-in-difference approach (Baker et al., 2008).

studies that distinguish centre- and home-based care also show that a positive

association is found for children attending centre-based care.[30]

Third, educated parents may also have better skills in gathering information regarding

the availability and quality of centres. Fourth, alternatively, it may be the case that

less educated mothers have a stronger preference to take care of children on their own.

It is beyond the scope of this paper to identify the relative importance of these

potential factors. To the extent that the income and information constraints are

relevant, the heterogeneous response to centre openings indicates there is a limitation

in improving general accessibility through increasing the number of facilities only.

The findings of this paper also prompt the question of whether the heterogeneous

take-up of centre-based care by educated and less educated mothers has implications

for children's outcomes. If the positive association between children's cognitive

development and the use of centre-based care is causal, the early move by educated

parents to secure a centre-based care place may be one of the first steps in creating

inequality in children's school achievement and later economic prosperity.[31]

Unfortunately, the data used in this paper do not allow for investigation of the impact

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[30] For example, Hill et al. (2002) match children in the control group to children in the treatment group under Infant Health and Development Program experiment, then compare the outcomes of the two groups separately depending on the actual childcare arrangements of the children in the control group. They show that the advantages of the treatment group are particularly more pronounced for children who would have received home-based care or parental care, rather than children who would have received centre-based care anyway. Using non-experimental data, Loeb et al. (2004) find that, among three counties in the US, continuous centre-based care users exhibit higher cognitive proficiencies controlling for the baseline language skills. On the other hand, continuous home-based care users show no significant difference compared to children cared for by relatives. Rather, they exhibit a higher score for aggressive behaviour. Loeb et al. (2007) also indicate that centre care users score highly in reading and maths, while children who received 'other non-parent' care (excluding Head Start care) show insignificant differences compared to children receiving no non-parental care.

[31] For example, Loeb et al. (2007) find that children who started attending centre-based care between the ages of 2 and 3 show the highest scores in reading and math. Children who started attending a year later or earlier still show higher scores compared to children cared for by parents, but the differences are smaller. On the other hand, more behavioural problems are found for children who started the earliest, between the ages of 0 and 1.

of centre openings on children's outcomes, except for the existence of long-term health problems. This seems too extreme to measure the possibly subtle—if any—effect of different types of child care. Not surprisingly, it does not indicate the effect of centre openings. Further evidence is needed on the impact of exposure to different types of non-parental care on children's outcomes.

Finally, the analysis of centre entry suggests centres are less likely to enter communities with low population growth and growing rental costs. This implies the need for public intervention in ensuring equal availability of centre-based care in countries where the private sector plays an important role in providing formal child care. In turn, the finding indicates that this availability issue could be mitigated by policy aimed at reducing start-up and current costs of providers opening in these communities. It is worth noting, however, that who takes advantage of increased availability and whether it increases maternal labour supply is another issue, as discussed above. It would be fruitful for future research to further explore the behaviour of child care providers and effective policies that complement the supply of child care from the private sector.
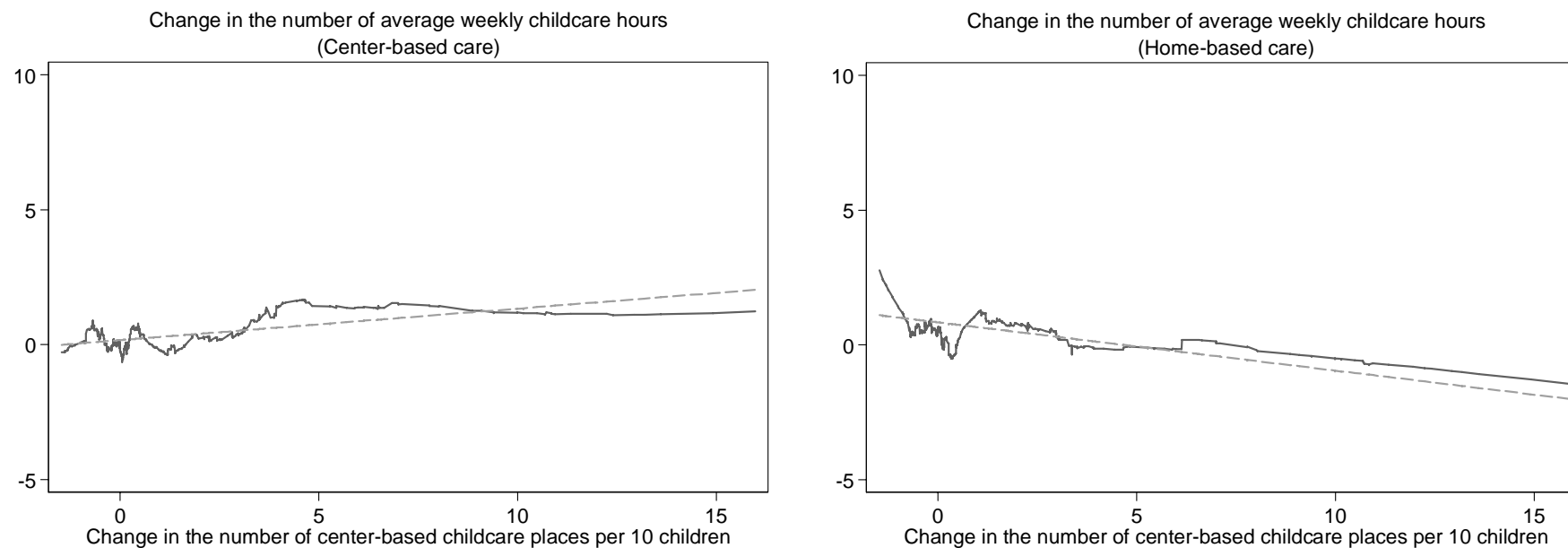
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Figure 1 Changes in Centre Availability and Changes in Average Weekly Childcare Time

Change in the number of average weekly childcare hours
(Center-based care)

Change in the number of average weekly childcare hours
(Home-based care)

Change in the number of center-based childcare places per 10 children

Change in the number of center-based childcare places per 10 children

Sources: The 2002-2004 Household, Income and Labour Dynamics in Australia (HILDA) Survey, the National Childcare Accreditation Council data, and the 2001 and 2006 Census.

Notes:
- The solid curve indicates the non-parametric estimates for the relationship between changes in centre-based care availability and changes in the average number of weekly childcare hours in a community (Statistical Local Area, SLA) between 2002 and 2003 as well as 2003 and 2004. The estimation is based on STATA's lowess procedure.
- The dashed line indicates the predictor based on a linear regression. The slope estimate is -0.179 for home-based care, with the p-value of 0.019. The equivalent figure for centre-based care is 0.117, with the p-value of 0.169.
- Households not using each type of childcare are assigned zero hours.
- For a household with more than one child aged 0-4, the average number of weekly childcare hours among the children is used.
- The average numbers are based on all households with married mothers of 0-4-year-olds who did not move across SLAs.

Figure 2 heterogeneity in Childcare Arrangement and Maternal Labour Supply by Marital Status, Age of Children, and Maternal Educational Attainment: 2002-2004

[A] Sample = Married Mothers with at Least One Child Aged 0-4
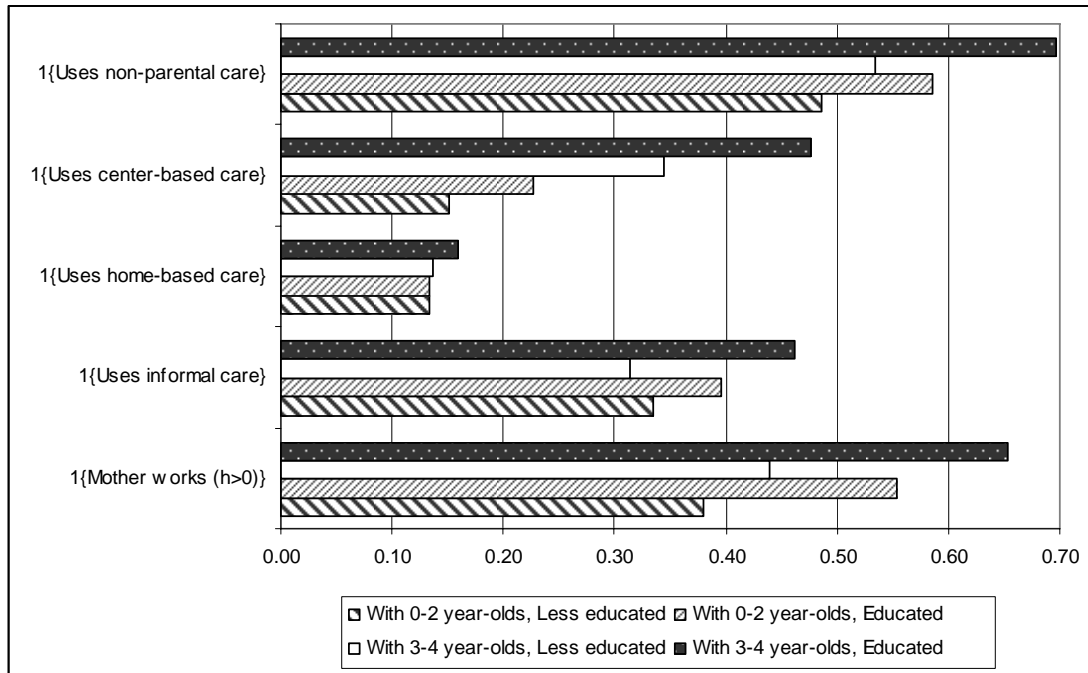
[B] Sample = Single Mothers with at Least One Child Aged 0-4

Sources: The 2002-2004 HILDA Survey.
Notes:
-   Centre-based care includes childcare centres (Long Day Care), kindergarten and preschools.
-   Home-based care includes care provided by registered, regulated carers at a carer's home or at a child's home (Family Day Care).
-   Informal care includes care provided by grandparents, relatives, friends, neighbours, and unregistered nannies, irrespective of whether households pay for the care or not.
-   Work includes paid work, self-employment work, and unpaid work for family members. Work hours include any paid or unpaid overtime, and if a person has more than one job, they include the hours worked in all jobs.
-   Educated mothers completed high school and hold a qualification or completed a bachelor degree or higher.

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Table 1: Summary Statistics for Variables Used in Analysis of Household Behaviour

|	Obs.	Mean	SD
Household-level Variables			
Outcome variables: childcare usage			
1{Household uses the following type of non-parental care for at least one hour in a usual week}			
some non-parental	2219	0.58	0.49
centre-based	2219	0.30	0.46
home-based	2219	0.14	0.35
informal	2219	0.38	0.48
Average weekly number of childcare hours per child, including non-users as zero			
some non-parental	2219	10.34	13.73
centre-based	2219	4.94	10.23
home-based	2219	2.52	7.78
informal	2219	2.89	7.08
Average weekly number of childcare hours per child, excluding non-users			
some non-parental	1368	16.78	14.06
centre-based	673	16.27	12.69
home-based	312	17.93	12.43
informal	829	7.73	9.85
Outcome variables: maternal labour supply			
1{Mother works (> 0 hour in a usual week)}	2219	0.51	0.50
Average weekly number of work hours, including non-working mothers as zero	2219	12.44	15.75
Average weekly number of work hours, excluding non-working mothers	1127	24.50	13.89
Household Characteristics			
Number of children aged 0	2219	0.31	0.48
Number of children aged 1	2219	0.25	0.44
Number of children aged 2	2219	0.25	0.44
Number of children aged 3	2219	0.27	0.46
Number of children aged 4	2219	0.28	0.46
Number of children aged 5-14	2219	0.76	0.97
Number of female members aged 15 and above	2219	0.05	0.24
Number of male members aged 15 and above	2219	0.05	0.24
Mother's characteristics			
Mother's age	2219	33.04	5.46
1{Mother is relatively educated}	2219	0.50	0.50
1{Mother has long-term health problems}	2219	0.10	0.30
Other covariates			
1{Observations in 2003}	2219	0.35	0.48
1{Observations in 2004}	2219	0.33	0.47
1{Observations in the state of New South Wales}	2219	0.31	0.46
1{Observations in the state of Victoria}	2219	0.26	0.44
1{Observations in the state of Queensland}	2219	0.20	0.40
Community (SLA)-level Variables			
Number of centre-based childcare places per 10 children aged 0-4	1002	3.30	2.92
Unemployment rate (%)	1002	6.13	2.99

Sources: The 2002-2004 Household, Income and Labour Dynamics in Australia (HILDA) Survey, the National Childcare Accreditation Council data, the 2001 and 2006 Census, and the Small Area Labour Markets data.
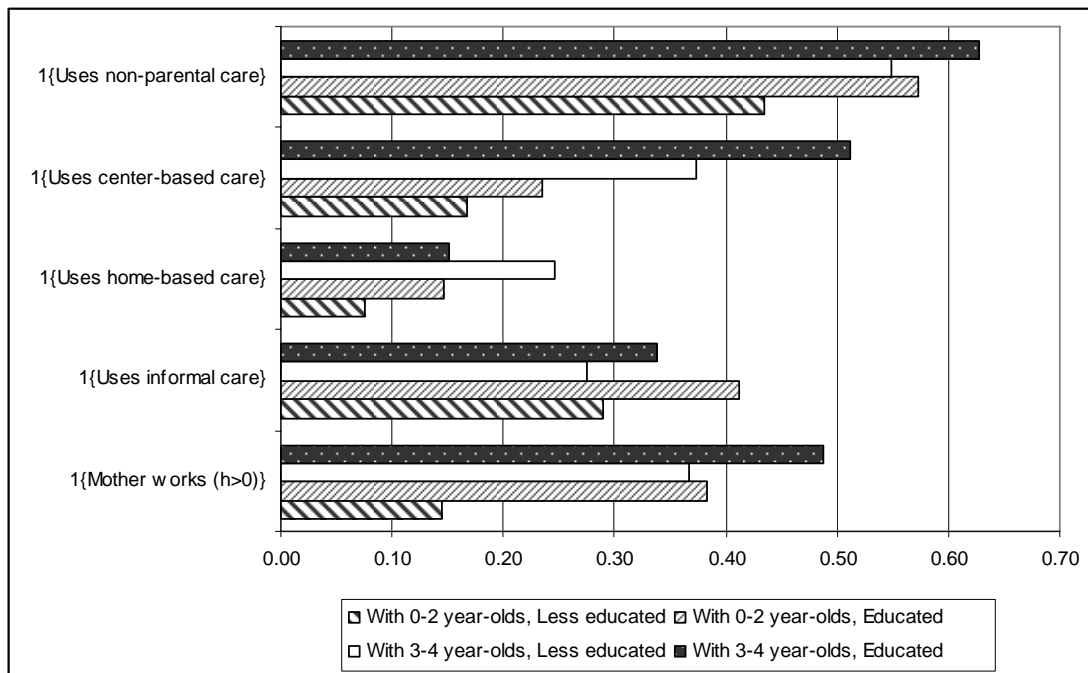
Notes:
- Centre-based care includes childcare centres (Long Day Care), kindergarten and preschools.
- Home-based care includes care provided by registered, regulated carers at a carer's home or at a child's home (Family Day Care).
- Informal care includes care provided by grandparents, relatives, friends, neighbours, and unregistered nannies, irrespective of whether households pay for the care or not.
- Average weekly number of childcare hours per child is the total number of hours used by all the pre school-aged children divided by the number of the children. Thirty-two percent of the sample have more than one child aged 0-4.
- Work includes paid work, self-employment work, and unpaid work for family members. Work hours include any paid or unpaid overtime, and if a person has more than one job, they include the hours worked in all jobs.
- Educated mothers completed high school and hold a qualification or completed a bachelor degree or higher.
- Long-term health problems are self-reported.
- There are four other states, but their sample size is too small to allow a separate dummy variable. In the regression analysis, the interaction between the year dummies and state dummies are also included.

Table 2 Effects of Centre-based Childcare Availability on Childcare Arrangement for Married Mothers: 2002-2004
Coefficient of the number of centre-based childcare places per 10 children in the residential community

		1{Parents use the following type of childcare}				Average weekly number of care hours per child (incl. zeros)					Average weekly number of care hours per child (excl. zeros)			
		Some non-parental care	Centre-based care	Home-based care	Informal care	Some non-parental care	Centre-based care	Home-based care	Informal care	N	Some non-parental care	N	Centre-based care	N
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	**All married mothers with 0-4-year-olds**	0.003	0.01	-0.042	0.005	0.008	0.764	-0.899	0.143	2219	-0.196	1368	1.172	673
		[0.028]	[0.028]	[0.020]**	[0.027]	[0.523]	[0.456]*	[0.433]**	[0.338]	(451)	[0.832]	(369)	[0.740]	(254)
B	Educated	0.021	0.035	-0.029	-0.03	-0.711	0.738	-1.307	-0.142	1120	-1.827	749	-0.184	392
		[0.039]	[0.039]	[0.029]	[0.029]	[0.823]	[0.819]	[0.755]*	[0.484]	(311)	[1.151]	(251)	[1.221]	(170)
C	Educated, without 3-4-year-olds	0.019	0.148	-0.138	-0.092	-1.71	2.558	-4.063	-0.205	568	-3.894	339	3.178	129
	(with 0-2-year-olds)	[0.063]	[0.042]***	[0.035]***	[0.048]*	[1.178]	[1.380]*	[1.143]***	[0.768]	(241)	[1.105]***	(175)	[3.910]	(90)
D	Educated, with 3-4-year-olds	-0.015	-0.071	0.043	0.009	-0.229	-1.338	0.463	0.646	552	-0.756	410	-0.261	263
		[0.041]	[0.050]	[0.035]	[0.082]	[1.128]	[0.853]	[0.609]	[0.637]	(210)	[1.332]	(183)	[0.922]	(135)
E	Less educated	-0.011	-0.018	-0.06	0.032	0.788	0.99	-0.72	0.518	1099	2.182	619	3.515	281
		[0.040]	[0.026]	[0.022]***	[0.032]	[0.906]	[0.693]	[0.517]	[0.497]	(317)	[0.906]**	(244)	[1.133]***	(149)
F	Less educated, without 3-4-year-olds	0.003	0.014	-0.086	0.032	1.02	-0.147	-0.697	1.864	504	-2.161	255	12.241	76
	(with 0-2-year-olds)	[0.089]	[0.059]	[0.052]*	[0.106]	[2.560]	[0.884]	[0.993]	[2.566]	(239)	[4.665]	(158)	[13.556]	(62)
G	Less educated, with 3-4-year-olds	-0.064	0.026	-0.088	-0.01	-0.281	1.183	-1.267	-0.198	595	1.963	364	3.47	205
		[0.046]	[0.045]	[0.040]**	[0.040]	[0.922]	[0.644]*	[0.762]*	[0.371]	(235)	[0.865]**	(181)	[1.241]***	(120)
H	Without 3-4-year-olds	0.021	0.054	-0.074	0.007	0.223	1.363	-1.853	0.713	1072	-0.81	594	4.563	205
	(with 0-2-year-olds)	[0.038]	[0.036]	[0.030]**	[0.037]	[0.878]	[1.031]	[0.567]***	[0.933]	(375)	[1.176]	(278)	[1.486]***	(137)
I	With 3-4-year-olds	-0.032	-0.004	-0.028	0.006	0.139	0.26	-0.335	0.214	1147	0.512	774	0.748	468
		[0.032]	[0.039]	[0.034]	[0.051]	[0.647]	[0.536]	[0.594]	[0.304]	(326)	[0.806]	(278)	[0.834]	(207)

Sources: See the sources listed in Table 1.
Notes:
- Each cell shows the coefficient of the number of centre-based childcare places per 10 children in the residential community, or *b* in Eq.(1), estimated for the outcome variable indicated by each column, and the sample indicated by each row. Due to the small sample size, the regressions in Column 12, Rows C and F cannot include covariates such as X_{ijt} and COM_{jt} in Eq.(1). Also, T_t is used instead of S_s*T_t.
- Standard errors that are clustered at the community (Statistical Local Area) level are shown in square brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
- Columns titled as 'N' indicates the number of observations (mothers) on the upper row, and the number of communities (Statistical Local Areas) in the lower row (in brackets).
- All the regressions control for the dummy indicating relatively educated mothers (defined as qualification or university degree holders, used only in Row A, H, and I), the dummy indicating mothers with long-term health conditions, and the unemployment rate.
- The controls also include household demographic characteristics such as the number of children aged 5-14 and the numbers of male and female members aged 15 or above. The numbers of children aged 0, 1, and 2 are additionally included for the results in Row A, B, C, E, F, H, and I, while the numbers of children aged 3 and 4 are used for the results in Row A, B, D, E, G, H, and I.
- The following three largest states are allowed to take different intercepts and year effects: New South Wales, Victoria, and Queensland. The rest of four states and territories have too small a sample size to define their own intercepts and year effects. The regressions in Column 12, Rows C and F only allow the inclusion of common year effects.
- The sample of home-based care users is too small to provide the effect on the average weekly care time excluding non-users. The results for informal care users indicate no significant effect.

Table 3 Effects of Centre-based Childcare Availability on Labour Supplied by Married Mothers: 2002-2004
Coefficient of the number of centre-based childcare places per 10 children in the residential community

		1{Mother works}	Weekly work hours including zeros	Weekly work hours among workers	Number of all mothers (SLAs)	Number of working mothers (SLAs)
		(1)	(2)	(3)	(4)	(5)
A	**All married mothers with 0-4-year-olds**	0.016	0.119	-0.995	2219	1127
		[0.039]	[0.952]	[0.891]	(451)	(345)
B	Educated	0.002	-0.411	-1.59	1120	675
		[0.039]	[1.152]	[1.039]	(311)	(249)
C	Educated, without 3-4-year-olds	-0.11	-3.506	-1.261	568	314
	(with 0-2-year-olds)	[0.064]*	[1.596]**	[1.331]	(241)	(175)
D	Educated, with 3-4-year-olds	0.067	2.279	-0.88	552	361
		[0.055]	[1.506]	[2.474]	(210)	(171)
E	Less educated	0.044	0.897	0.772	1099	452
		[0.035]	[0.844]	[1.650]	(317)	(184)
F	Less educated, without 3-4-year-olds	0.07	-0.321	-1.644	504	191
	(with 0-2-year-olds)	[0.110]	[2.942]	[7.173]	(239)	(116)
G	Less educated, with 3-4-year-olds	-0.01	-0.647	0.027	595	261
		[0.043]	[1.060]	[1.289]	(235)	(137)
H	Without 3-4-year-olds	-0.001	-1.159	-2.541	1072	505
	(with 0-2-year-olds)	[0.051]	[1.357]	[1.173]**	(375)	(253)
I	With 3-4-year-olds	0.019	0.966	-0.674	1147	622
		[0.045]	[1.103]	[1.211]	(326)	(247)

Sources: See the sources listed for Table 1.
Notes:
- Each cell shows the coefficient of the number of centre-based childcare places per 10 children in the residential community, or *b* in Eq.(1), estimated for the outcome variable indicated by each column, and the sample indicated by each row.
- Standard errors that are clustered at the community (Statistical Local Area) level are shown in square brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
- All the regressions control for the dummy indicating relatively educated mothers (defined as qualification or university degree holders, used only in Row A, H, and I), the dummy indicating mothers with long-term health conditions, and the unemployment rate.
- The controls also include household demographic characteristics such as the number of children aged 5-14 and the numbers of male and female members aged 15 or above. The numbers of children aged 0, 1, and 2 are additionally included for the results in Row A, B, C, E, F, H, and I, while the numbers of children aged 3 and 4 are used for the results in Row A, B, D, E, G, H, and I.
- The following three largest states are allowed to take different year effects: New South Wales, Victoria, and Queensland. The remaining four states and territories have too small a sample size to define their own year effects.

Table 4 Effects of Centre-based Childcare Availability on Childcare Arrangement for Married Mothers Who Did Not Move across Communities: 2002-2004

Coefficient of the number of centre-based childcare places per 10 children in the residential community

		1{Parents use the following type of childcare}				Average weekly number of care hours per child (incl. zeros)					Average weekly number of care hours per child (excl. zeros)			
		Some non-parental care	Centre-based care	Home-based care	Informal care	Some non-parental care	Centre-based care	Home-based care	Informal care	N	Some non-parental care	N	Centre-based care	N
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A	All married mothers with 0-4-year-olds	-0.001	0.013	-0.045	-0.008	-0.222	0.894	-1.128	0.011	1846	-0.531	1128	0.667	550
		[0.027]	[0.033]	[0.025]*	[0.028]	[0.503]	[0.419]**	[0.499]**	[0.314]	(368)	[0.728]	(301)	[0.819]	(207)
B	Educated	0.005	0.023	-0.041	-0.035	-1.264	0.436	-1.733	0.033	947	-1.915	629	-0.597	326
		[0.033]	[0.037]	[0.026]	[0.030]	[0.741]*	[0.738]	[0.609]***	[0.499]	(257)	[1.002]*	(208)	[1.020]	(143)
C	Educated, without 3-4-year-olds (with 0-2-year-olds)	0.009	0.14	-0.162	-0.11	-1.885	3.041	-4.877	-0.048	470	-3.209	276	6.181	99
		[0.046]	[0.038]***	[0.033]***	[0.049]**	[0.972]*	[1.074]***	[0.924]***	[0.939]	(195)	[0.921]***	(142)	[2.727]**	(72)
D	Educated, with 3-4-year-olds	-0.023	-0.061	0.036	0.01	-0.728	-1.229	0.002	0.499	477	-1.151	353	-1.092	227
		[0.042]	[0.050]	[0.030]	[0.082]	[0.991]	[0.647]*	[0.403]	[0.591]	(175)	[1.193]	(155)	[0.790]	(118)
E	Less educated	-0.021	-0.014	-0.05	-0.003	0.57	1.237	-0.584	-0.083	899	2.361	499	4.53	224
		[0.043]	[0.031]	[0.031]	[0.032]	[0.997]	[0.759]	[0.638]	[0.370]	(247)	[1.084]**	(194)	[1.411]***	(114)
F	Less educated, without 3-4-year-olds (with 0-2-year-olds)	-0.065	0.042	-0.076	-0.049	-1.744	0.238	-0.624	-1.358	403	-6.711	197	8.034	59
		[0.107]	[0.064]	[0.063]	[0.125]	[2.082]	[0.897]	[1.226]	[1.612]	(178)	[5.010]	(120)	[19.020]	(47)
G	Less educated, with 3-4-year-olds	-0.093	0.007	-0.07	-0.044	-0.365	1.208	-0.961	-0.611	496	2.25	302	3.111	165
		[0.047]**	[0.033]	[0.041]*	[0.039]	[1.151]	[0.764]	[0.766]	[0.354]*	(197)	[0.924]**	(150)	[1.043]***	(92)
H	Without 3-4-year-olds (with 0-2-year-olds)	0.011	0.084	-0.12	-0.055	-1.326	2.076	-3.461	0.059	873	-2.778	473	7.345	158
		[0.035]	[0.043]*	[0.036]***	[0.056]	[0.927]	[1.094]*	[1.066]***	[0.745]	(297)	[1.065]***	(223)	[3.528]**	(107)
I	With 3-4-year-olds	-0.053	-0.009	-0.03	-0.013	-0.296	0.159	-0.511	0.056	973	0.331	655	0.376	392
		[0.029]*	[0.034]	[0.031]	[0.053]	[0.653]	[0.475]	[0.488]	[0.306]	(277)	[0.765]	(236)	[0.810]	(172)

Sources: See the sources listed in Table 1.

Notes:

- Each cell shows the coefficient of the number of centre-based childcare places per 10 children in the residential community, or b in Eq.(1), estimated for the outcome variable indicated by each column, and the sample indicated by each row. Due to the small sample, the regressions in Column 12, Rows C, F, G and H cannot include covariates such as X_{ijt} and COM_{jt} in Eq.(1). Also, T_t is used instead of S_s*T_t.
- Standard errors that are clustered at the community (Statistical Local Area) level are shown in square brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
- Columns titled as 'N' indicate the number of observations (mothers) on the upper row, and the number of communities (Statistical Local Areas) in the lower row (in brackets).
- All the regressions control for the dummy indicating relatively educated mothers (defined as qualification or university degree holders, used only in Row A, H, and I), the dummy indicating mothers with long-term health conditions, and the unemployment rate. The controls also include household demographic characteristics such as the number of children aged 5-14 and the numbers of male and female members aged 15 or above. The numbers of children aged 0, 1, and 2 are additionally included for the results in Row A, B, C, E, F, H, and I, while the numbers of children aged 3 and 4 are used for the results in Row A, B, D, E, G, H, and I.
- The following three largest states are allowed to take different intercepts and year effects: New South Wales, Victoria, and Queensland. The remaining four states and territories have too small a sample size to define their own intercepts and year effects. The regressions in Column 12, Rows C, F, G and H only allow the inclusion of common year effects.
- The sample of home-based care users is too small to provide the effect on the average weekly care time excluding non-users. The results for informal care users indicate few significant effects.

Table 5 Effects of Centre-based Childcare Availability on Labour Supplied by Married Mothers Who Did Not Move across Communities: 2002-2004
Coefficient of the number of centre-based childcare places per 10 children in the residential community

		1{Mother works}	Weekly work hours including zeros	Weekly work hours among workers	Number of all mothers (SLAs)	Number of working mothers (SLAs)
		(1)	(2)	(3)	(4)	(5)
A	**All married mothers with 0-4-year-olds**	0.018	-0.451	-1.644	1846	964
		[0.033]	[0.889]	[0.802]**	(368)	(293)
B	Educated	0.007	-0.997	-2.197	947	571
		[0.035]	[1.161]	[0.915]**	(257)	(208)
C	Educated, without 3-4-year-olds	-0.061	-3.66	-2.351	470	262
	(with 0-2-year-olds)	[0.047]	[1.609]**	[1.323]*	(195)	(141)
D	Educated, with 3-4-year-olds	0.038	1.034	-2.2	477	309
		[0.064]	[1.807]	[2.326]	(175)	(146)
E	Less educated	0.022	0.198	0.511	899	393
		[0.036]	[0.928]	[1.410]	(247)	(158)
F	Less educated, without 3-4-year-olds	-0.011	-4.402	-9.49	403	163
	(with 0-2-year-olds)	[0.131]	[3.090]	[7.148]	(178)	(98)
G	Less educated, with 3-4-year-olds	-0.027	-0.67	0.658	496	230
		[0.038]	[1.057]	[1.237]	(197)	(119)
H	Without 3-4-year-olds	-0.017	-3.713	-3.271	873	425
	(with 0-2-year-olds)	[0.052]	[1.635]**	[1.390]**	(297)	(211)
I	With 3-4-year-olds	0.002	0.088	-1.513	973	539
		[0.047]	[1.215]	[1.201]	(277)	(216)

Sources: See the sources listed for Table 1.
Notes: See the notes for Table 3.

Table 6: Summary Statistics for Variables Used in Analysis of Childcare Centre Entry

Unit = community (SLA) * year	Obs.	Mean	SD
Outcome variable			
Number of childcare centres	4021	3.01	6.22
Rental cost proxies (previous year)			
1{At least ten housing sales}	4021	0.97	0.17
1{At least ten housing sales} *ln[median housing price ($)]	4021	3.87	3.51
1{At least ten industry property sales}	4021	0.05	0.21
Median industry property price per square meter ($1000) * 1{At least ten industry property sales}	4021	0.01	0.11
1{At least ten commercial property sales}	4021	0.20	0.40
Median commercial property price per square meter ($1000) * 1{At least ten commercial property sales}	4021	0.10	0.44
1{At least ten retail property sales}	4021	0.01	0.12
Median retail property price per square meter ($1000) * 1{At least ten retail property sales}	4021	0.01	0.22
Wage cost proxies (previous year)			
1{At least one woman aged 18-65 earns wage income} (HILDA)	1601	0.86	0.35
1{At least one woman aged 18-65 earns wage income} * average hourly gross wage rate ($) (HILDA)	1601	18.17	12.63
1{At least one individual reports wage income for tax purposes} (Census)	4021	0.99	0.11
1{At least one individual reports wage income for tax purposes} * average annual gross earned income ($1000) (Census)	4021	35.95	7.63
Area characteristics (previous year)			
Median per capita weekly gross household income ($1000) (Census)	4021	565	286
Median per capita weekly gross household gross income ($1000) (HILDA)	1601	465	324
Total population (1,000 persons) (Census)	4021	14.30	23.04
Share of adults aged 20-49 who hold a Bachelor's degree or higher (HILDA)	1601	0.24	0.26
Share of adults aged 20-49 who hold a qualification (HILDA)	1601	0.32	0.24
Shares of population by age group (0-2) (Census)	4021	0.04	0.01
Shares of population by age group (3-4) (Census)	4021	0.03	0.01
Shares of population by age group (5-9) (Census)	4021	0.07	0.02
Shares of population by age group (10-19) (Census)	4021	0.14	0.03
Shares of population by age group (20-49) (Census)	4021	0.43	0.07
Shares of population by age group (0-2) (HILDA)	1601	0.05	0.07
Shares of population by age group (3-4) (HILDA)	1601	0.03	0.05
Shares of population by age group (5-9) (HILDA)	1601	0.07	0.08
Shares of population by age group (10-19) (HILDA)	1601	0.14	0.12
Shares of population by age group (20-49) (HILDA)	1601	0.50	0.21
Maternal labour supply indicators (previous year)			
Share of mothers of 0-4-year-olds working at least one hour (HILDA)	1101	0.48	0.38
Average number of work hours (including zeros) (HILDA)	1101	12.15	11.99

Sources: The 2002-2004 HILDA Survey, the National Childcare Accreditation Council data, the 2001 and 2006 Census, the Small Area Labour Markets data, and Australian Property Monitor data, the 2001 and 2006 Census, 2001-04 Regional Wage and Salary Earner Statistics, Australia.

Notes: All the values are in terms of 2005 Australian dollars. See Appendix 1 for the definition and sources of the variables.

Table 7 Number of Childcare Centres and Community Characteristics: 2002-2004
Sample = All communities / communities covered by the HILDA Survey

Outcome = Number of childcare centres	(1)	(2)	(3)	(4)
Rental cost proxies (previous year)				
1{At least ten housing sales}	-0.011	0.435	0.336	0.412
	[0.097]	[0.340]	[0.258]	[0.355]
1{At least ten housing sales} *ln[median housing price ($)]	-0.006	-0.121	-0.084	-0.109
	[0.008]	[0.072]*	[0.039]**	[0.067]
1{At least ten industry property sales}	0.006	-0.107	-0.071	-0.084
	[0.122]	[0.229]	[0.176]	[0.235]
Median industry property price per square meter ($1000) * 1{at least ten industry property sales}	0.087	0.003	0.141	-0.069
	[0.165]	[0.382]	[0.218]	[0.396]
1{at least ten commercial property sales}	0.135	0.089	0.134	0.14
	[0.053]**	[0.134]	[0.110]	[0.132]
Median commercial property price per square meter ($1000) * 1{at least ten commercial property sales}	-0.049	-0.025	-0.048	-0.036
	[0.054]	[0.063]	[0.069]	[0.064]
1{at least ten retail property sales}	0.162	1.22	0.568	1.274
	[0.179]	[0.759]	[0.390]	[0.903]
Median retail property price per square meter ($1000) * 1{at least ten retail property sales}	-0.053	-2.165	-1.171	-2.365
	[0.042]	[0.935]**	[0.495]**	[1.100]**
Wage cost proxies (previous year)				
1{At least one individual reports wage income for tax purposes}	0.737	3.727		
	[0.379]*	[2.138]*		
1{At least one individual reports wage income for tax purposes} * average annual gross earned income ($1000)	-0.021	-0.118		
	[0.010]**	[0.061]*		
1{At least one woman aged 18-65 earns wage income} (HILDA)			0.066	0.033
			[0.079]	[0.120]
1{At least one woman aged 18-65 earns wage income} * average hourly gross wage rate ($) (HILDA)			-0.001	-0.001
			[0.001]	[0.002]
Area characteristics (previous year)				
Median per capita weekly gross household income ($1000) (Census)	0.252	0.042		
	[0.196]	[1.109]		
Median per capita weekly gross household gross income ($1000) (HILDA)			-0.028	-0.445
			[0.174]	[0.280]
Total population (1,000 persons) (Census)	0.506	0.67	0.559	0.646
	[0.116]***	[0.217]***	[0.173]***	[0.203]***
Share of adults aged 20-49 who hold a Bachelor's degree or higher (HILDA)			-0.251	-0.611
			[0.163]	[0.354]*
Share of adults aged 20-49 who hold a qualification (HILDA)			-0.361	-0.966
			[0.139]***	[0.413]**
Shares of population by age group (0-2, 3-4, 5-9, 10-19, 20-49)	Census	Census	HILDA	HILDA
Maternal labour supply indicators (previous year)				
Share of mothers of 0-4-year-olds working at least one hour (HILDA)		-0.022		0.01
		[0.146]		[0.147]
Average number of work hours (including zeros) (HILDA)		0.002		0.002
		[0.004]		[0.004]
1{2003}	0.05	0.164	0.18	0.18
	[0.023]**	[0.088]*	[0.053]***	[0.065]***
1{2004}	0.193	0.431	0.423	0.479
	[0.041]***	[0.167]***	[0.091]***	[0.115]***
Observations	4021	1101	1601	1101
SLAs	1341	465	715	465
F-stat	20.88	8.96	10.42	8.07

Sources: See the sources listed for Table 6.
Notes:
- Standard errors that are clustered at the community (Statistical Local Area) level are shown in square brackets.
- * significant at 10%; ** significant at 5%; *** significant at 1%.
- See Appendix 1 for the definition and sources of the variables.

Appendix Table: Effects of Centre-based Childcare Availability on Labour Supplied by Married Mothers of Older Children and Childless Women: 2002-2004
Coefficient of the number of centre-based childcare places per 10 children in the residential community

	1{Mother works}	Weekly work hours including zeros	Weekly work hours among workers	Number of all mothers (SLAs)	Number of working mothers (SLAs)
	(1)	(2)	(3)	(4)	(5)
A **All married mothers with 5-18-year-olds**	0.003	0.842	1.305	2566	1926
(no 0-4-year-olds)	[0.024]	[0.753]	[1.475]	(320)	(303)
B Educated	-0.026	-0.17	0.831	1155	955
	[0.033]	[1.449]	[1.282]	(247)	(229)
C Less educated	0.005	0.947	1.447	1411	971
	[0.032]	[0.983]	[2.315]	(265)	(233)
D **All married women with no 0-18-year-olds**	-0.017	-1.157	-0.734	1587	1338
	[0.022]	[1.159]	[1.104]	(306)	(287)
E Educated	0.002	-0.93	-0.864	905	821
	[0.032]	[1.958]	[1.693]	(231)	(216)
F Less educated	-0.017	-1.005	-0.632	682	517
	[0.037]	[1.688]	[1.635]	(237)	(204)

Sources: See the sources listed for Table 1.
Notes:
- Each cell shows the coefficient of the number of centre-based childcare places per 10 children in the residential community, or b in Eq.(1), estimated for the outcome variable indicated by each column, and the sample indicated by each row.
- Standard errors that are clustered at the community (Statistical Local Area) level are shown in square brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.
- All the regressions control for the dummy indicating relatively educated mothers (defined as qualification or university degree holders, used only in Row A and D), the dummy indicating mothers with long-term health conditions, and the unemployment rate.
- The controls also include household demographic characteristics such as the number of children aged 5-14 (Rows A-C only) and the numbers of male and female members aged 15 or above.
- The following three largest states are allowed to take different year effects: New South Wales, Victoria, and Queensland. The remaining four states and territories have too small a sample size to define their own year effects.

Appendix 1: Sources and definitions of Community (Statistical Local Area (SLA))-level data

- **The number of centre-based childcare places per 10 children**

    The information on the location (postcode) and accreditation history of centre-based care providers was collected using an automated procedure in May 2005 from the website of the National Childcare Accreditation Council (NCAC). NCAC is responsible for the registration of childcare providers and quality assessment under the federal quality-assurance system. The original information was converted into the year*SLA-level data based on the concordance file that converts the 2006 postcode into the 2001 SLA (The Australian Bureau of Statistics). The total number of providers was then divided by the number of children aged 0-4 years who are unlikely to have started school under the system, mandating their start by the age of six. The numbers of children for each SLA were interpolated based on the 2001 and 2006 Census (Time Series Profile of the Australian Bureau of Statistics Datapack).

- The unemployment rate

    The data for each area and year were extracted from the Small Area Labour Markets (the Department of Employment and Work Relation).

- Rental cost proxies

    The information on the number of sales and median prices of housing / non-residential property was provided by the Australian Property Monitor for each SLA and year. Housing value was available in the log form, while non-residential property value was available in the median price per square meter. Industry, commercial, and retail property included structures such as factories, offices, and shops, respectively.

- Wage cost proxies

    The gross hourly wage rate was estimated based on working women aged 18-65 interviewed in the HILDA Survey. The wage income referred to usual gross income earned from all jobs per week, which was divided by the usual number of hours worked for all jobs per week. This individual wage rate was then aggregated to the SLA level. Thus, the average wage rate was available only for areas covered by the HILDA Survey.

    A proxy for the wage rate was available for all the areas - the gross wage income for wage workers based on the Tax Office records (provided in the Regional Wage and Salary Earner Statistics, Australia [the Australian Bureau of Statistics, 5673.0.55.003]). Persons aged 15 years and over who had submitted an individual income tax return were included if the wage and salary income was the principal (or main) source of income for the persons for the financial year. The wage income included gross salary, allowances, commissions, bonuses, tips, gratuities, consultation fees, honoraria and other payments for services. Although the number of hours was unavailable, to the extent that it was similar across areas and years, the gross wage income provided a proxy for the average gross wage rate.

- Area characteristics

    Per capita household income was obtained from two sources. One was the 2001 and 2006 Census, which provided the area-specific interpolated values of median household gross weekly income and median household size. The household income was the sum of the individual incomes reported by all household members aged 15 years and over. The other was the HILDA Survey, which provided the weekly gross income and household size for each household. The median value of the gross annual per capita household income was used for each area and year.

    Total population was based on the values interpolated from the 2001 and 2006 Census.

    The share of adults aged 20-49 who held a bachelor's degree or higher and the share of those holding a qualification were based on individuals interviewed in the HILDA Survey.

    The shares of population by age group were obtained from two sources: the Census-based interpolation and the sample estimates from the HILDA Survey.

- Maternal labour supply indicators

    Maternal labour supply indicators are the sample estimates from the HILDA Survey. Since only mothers of 0-4-year-olds were included in this estimation, fewer areas had non-missing values of the indicators.

Appendix 2: The federal childcare policy in Australia: 2002-2004

This section summarises the major federal childcare policy that was in place in the analysis period. It consisted of a price subsidy, quality assurance, and direct support for providers.

The price subsidy (Child Care Benefit), the largest expenditure item, provided a means-tested hourly benefit to a household using childcare, according to the number of hours used by the child(ren). Thus, a poorer household was able to use the same service at a lower fee, though the childcare expenditure typically occupied a larger proportion of household disposable income (Toohey, 2005). Parents were able to claim this payment for up to 24 hours of care per child without working, and working parents were eligible for up to 50 hours of child care.[32] A more generous subsidy rate was applied to the usage of government-approved care providers, which satisfied the national quality standards set under the Child Care Quality Assurance (CCQA) system.[33] Approved care included LDC, FDC, and preschools/kindergarten that opted into the system. Providers of centre-based care examined in this paper were all participating and generally approved under this system.[34]

A small proportion of childcare expenditure was spent on support for providers operating in areas deemed as scarce of supply. These programs provided certain incentives to households and providers. These incentives were in place for the entire analysis period.

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[32] This also applies to parents who are studying, looking for work, or undertaking training for 15 hours or more per week.

[33] To be approved or accredited, providers must satisfy a set of standards related to staff relationships with children and peers, partnerships with families, learning environments, safety, nutrition and health, and management practices (National Childcare Accreditation Council, 2006). Parents using informal care (such as grandparents, relatives, friends and unregulated nannies) can register their providers and receive a lower rate of subsidy. As of 2006, the hourly subsidy was $3.37 for approved care and $0.564 for registered care.

[34] Due to the link to the subsidy program, a majority of childcare providers, including LDC and some preschools, was likely to participate in the scheme. Between 2002–2004, most (95%, based on the data collected by the author) participating providers were accredited.