

Fourth, childcare is highly labour intensive; labour cost accounts for about two thirds of total cost, which lead to limited scale economy.

2.2 Childcare Price Subsidies

Governments often attempt to correct some of these market failures or to expand the availability and affordability of quality childcare. One of the most common measures is price subsidies.¹⁰ In general, recent studies on demand for childcare have found that a reduction in the price of childcare induces utilization and maternal labour supply.¹¹

This evidence suggests that price subsidies are likely to expand demand.

However, it is unclear to what extent such demand expansion leads to consumer surplus increase. The pass-through rate, i.e. how much amount of the price subsidy a firm transfers to consumers by lowering the price, depends on the market power of the

educational opportunities, and convenience to the parents. Walker (1992) also analysed differential services offered by home-based (as opposed to centre-based) childcare providers in three U.S. cities.

¹⁰ Other measures include quality assurance measures, which are taken to address the information asymmetry, and subsidies to providers, which are used in order to promote entry in regions with limited access to formal childcare and thus competition.

¹¹ For example, Baker, Gruber and Milligan (2008) found that, following the introduction of subsidized childcare in the Canadian province of Quebec, it exhibited an extra increase in overall usage of childcare among married mothers by 15 percentage points, one-third of which was due to a shift away from non-subsidized care toward subsidized care. The study also identifies an increase in married mothers' labour force participation by 8 percentage points. Similar results have been found in the US for single mothers who have children aged for preschool (five year-olds) but do not have younger children (Cascio (2006) and Gelbach (2002)). Earlier studies provided more mixed evidence, which is reviewed by, for example, Anderson and Levine (2000), Blau (2003), Blau and Currie (2004), and Baker et al. (2005).

firm. Our analysis shed light on this issue by studying the market power of childcare centres existing in markets with different sizes of child population.

For example, Australia has two forms of subsidies: the Child Care Benefit (CCB) and the Child Care Tax Rebate (CCTR). These heavy subsidies have been a driving force of the large private-sector in Australian childcare. All these policies determine the market structure, prices, and quality of care. For such policies to be efficient and effective, sound knowledge of the industry is indispensable.

2.3 Analyses on the Childcare Industry

Several studies have looked at some aspects of the behaviour of childcare providers; however, evidence has not yet been provided on the competitiveness of the industry.

One set of existing studies focuses on the impact of regulations on childcare providers mainly in the U.S. Tougher regulations regarding staff-child ratio, group size, and staff qualifications were found to be associated with reduced staff wages based on the 1993 cross section data on childcare providers (Blau, 2006). Hotz and Xiao (2005) utilized unique panel data combining information on childcare providers, state regulation, and administrative accreditation records. They find that higher staff-child ratio requirements raise an entry barrier, while higher staff-education requirements

increase the exit of providers. These results suggest that regulation specifies the nature of the industry.

Another set of studies investigates the elasticity of supply of quality and labour to childcare. Blau and Mocan (2002) estimated the quality supply function using the score designed by developmental psychologists as a quality measure. Their results suggest that childcare providers exhibit moderate elasticity in improving quality in response to increases in the price of childcare and the wage of childcare workers. Blau (1993, 2001) studied the elasticity of supply of labour to childcare - an important input in the production of the service. Based on the relatively high elasticity estimated, he concluded that the majority of the benefits of childcare subsidies accrue to consumers.

However, even if labour supply of childcare workers is responsive to changes in the wage rate, if childcare providers may have a certain market power, not behaving as a price taker. With the assumption of perfect competition relaxed, it is unclear how responsive childcare providers are to changes in demand in adjusting the level of service quality and the wage rate of workers. Our analysis does not directly address such responsiveness, but does provide direct evidence on changes in market power

associated with changes in demand, using the cross sectional variation in demand size as well as a change in demand induced by a policy change.

2.4 The Australian Childcare Market and Childcare Policy

In Australia, formal childcare is broadly categorized into centre-based and home-based care. Centre-based care is offered at institutions such as childcare centres (Long Day Care, LDC), kindergartens and preschools. Home-based care is provided by carers, either within their own homes or within the child's home.¹² In addition to these two types of formal service, informal care is given by relatives, friends and unregistered nannies. During the analysis period, an average of 31% of households used centre-based care for at least one hour per week, while home-based and informal care was used by 15% and 37% of households, respectively.¹³

The major childcare policy has been formulated at the federal level, and the federal level programs account for a large proportion of public expenditure on children's

¹² Among the two types of formal care, centre-based care providers tend to emphasize learning activities and hire more qualified staff. For example, 88 percent and 87 percent of private and community-based Long Day Care (centre-based care) staff have relevant qualifications or experience, respectively. The equivalent figure is 70 percent among Family Day Care (home-based care) providers (Department of Family and Community Services, 2004). Positive associations are also found between children's cognitive outcomes and the use of centre-based, not home-based, childcare (Hill et al., 2002 and Loeb et al., 2004, 2007). Thus, increasing parental interest in early childhood education is likely to amplify the demand for centre-based care, which is the focus of this paper.

¹³ Based on the Household, Income and Labour Dynamics in Australia.

services.¹⁴ In the first four years of our analysis period (2001 and 2004), the childcare policy did not significantly change. It consisted of a price subsidy, quality assurance, and direct support for providers. Among these, the price subsidy (Child Care Benefit) was the largest expenditure item. This subsidy was available to all the households using childcare. However, since the hourly subsidy rate was means-tested, it allowed a poorer household to use the same service at a lower fee.¹⁵ The CCB also provided more benefits to working parents. While they were able to claim benefits for up to 24 hours of care per week per child without working, working parents were eligible for up to 50 hours of childcare.¹⁶ In addition, the CCB encouraged the usage of government-approved care providers because a more generous subsidy rate was applied to such usage. Government-approved care providers had to satisfy the national quality standards set under the Child Care Quality Assurance (CCQA) system,¹⁷ and

¹⁴For example, in the 2006/07 fiscal year, the Australian Government accounted for 78 percent of total government expenditure on children's services (A\$3.03billion) (Steering Committee for the Review of Government Service Provision, 2008).

¹⁵For example, the maximum hourly subsidy rate was \$2.74 in the fiscal year of 2003-2004. This was payable to households with the annual income lower than or equal to \$31,755. On the other hand, households with the annual income higher than \$91,035 were eligible to the hourly subsidy rate of \$0.46. Households with the income falling between the lower and upper thresholds received the hourly subsidy rate which was adjusted for their income level. The CCB system also provided a larger amount of benefit to households with multiple children as higher values of upper income threshold and hourly subsidy rate were applied to those households. Though a low-income household received higher subsidies, the childcare expenditure typically occupied a larger proportion of household disposable income (Toohey, 2005).

¹⁶This also applies to parents who are studying, looking for work, or undertaking training for 15 hours or more per week.

¹⁷To 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 (NCAC), 2006a). 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

they included LDC 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.¹⁸ 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.

A major change in the childcare policy was the introduction of a new subsidy called Child Care Tax Rebate (CCTR), which started from the beginning of 2005.¹⁹ This program initially provided childcare users who applied for CCB and met the CCB work/ study/ training test with a payment that is 30 percent of their out-of pocket expenses,²⁰ over and above those covered by the CCB.

The CCTR is likely to have affected households where mothers were working or

care and \$0.564 for registered care.

¹⁸Due 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 2001--2006, most (95%, based on the data collected by the author) participating providers were accredited.

¹⁹The CCTR was originally announced as a policy proposal in October 2004 during the Federal election campaign. At that time, it was indicated that the CCTR would come into effect on 1 January 2005. Following the election, additional details became available about the operation of the CCTR. These included that the CCTR would in fact be paid from 1 July 2004. That is, 'out of pocket' childcare costs incurred after 1 July 2004 would be eligible to attract CCTR payments. Thus, the behavior of households was unlikely to have been affected before this additional announcement. Based on the timing of policy announcements, we treat the year of 2005 to be the first year in which the market structure was affected by the introduction of CCTR.

²⁰This figure was later raised to 50 percent in 2008.

willing to start working, because the work/ study/ training test required the users of childcare to be working, studying or receiving training for work. Unlike CCB, the CCTR is non-means-tested, and thus an increase in the value of subsidies due to the program was larger for high income households.²¹ Another feature of the CCTR which made the benefit level larger for households with higher income was that the CCTR was non-refundable. That is, if insufficient tax was payable by households using childcare, it was not paid. This was changed from the fiscal year of 2006-2007, from which the CCTR was no longer limited to a household's tax liability.

In this paper, we investigate the impact of this exogenous shock on the market structure. Since there was a lag in payment in the initial years of the CCTR introduction, it is unclear whether changes in the market structure took place immediately. That is, payment of the CCTR would not be made for at least 18 months after the childcare costs were incurred. The amount of CCB that the individual was eligible for could only be identified once the final amount of childcare expenses and income was calculated. This occurred in the next financial year when a tax return was filed. That is, expenses incurred in July 2004 (June 2005) would attract a CCTR

²¹While the value of claimable CCTR was capped per child (for example, \$4,000 for the 2004-05 financial year, and \$4,096 for the 2005-06 financial year), it is unlikely to be binding for many households. This cap was also raised to \$7500 in 2008.

payment 27 months (15 months) later in Sept. 2006 when the tax return for the fiscal year 2005-06 was lodged/ processed. Nevertheless, to the extent that consumers are foresighted, their response can be observed immediately in 2005 following the launch of the CCTR.

3 Model

3.1 The Entry Model

We apply the framework of Bresnahan and Reiss (1991) to the childcare industry. The model relates the number of firms in a market to market size and characteristics of that market. This model allows us to examine the determination of market structure observing entry decisions by firms, without data on profits, prices, costs, and firm characteristics.

A firm's entry decision depends on whether or not the firm expects to earn positive profits following entry. Consider an entry decision of a firm in a market that already has N firms. The long-run discounted profits of the firm are given by:

$$\Pi(N, S, X) + \varepsilon$$

where S is the market size and X is a set of market characteristics variables that affect profits. Whereas we assume that each firm observes its potential profits, we do not

observe the profit of each firm. We view the equilibrium profits as random variables and introduce an error term ϵ that summarizes the profits that the model cannot explain. Thus, $\Pi(N, S, X)$ is expected profit. Furthermore, the value of ϵ is assumed to be at the market level error and common to every firm in a market.

The market equilibrium number of entrants, N , is determined by the best response entry decisions of potential firms. This entry game assumes that each market has infinitely many potential entrants and all firms play a one-shot static entry game as a "potential entrant".²² Assuming $\Pi(N, S, X)$ is decreasing in N , the equilibrium number of entrants in a market is the maximum number that the market can profitably sustain. Formally, denoting $\Pi_N \equiv \Pi(N, S, X)$, the equilibrium number of firms in a market, N , is characterized by the following inequalities:

We assume the market level random component of profits, ϵ , is independently distributed across markets, independent of the explanatory variables, and has a normal

²²Therefore, any dynamic aspect is abstracted away in this framework. In particular, this framework does not distinguish incumbents and new entrants.

distribution with zero mean and a constant variance.²³ The probability of observing a particular number of firms, N^* , in a market is:

$$\begin{aligned}
 P(N^* = 0) &= 1 - \Phi(\Pi_1), \\
 P(N^* = 1) &= \Phi(\Pi_1) - \Phi(\Pi_2), \\
 P(N^* = 2) &= \Phi(\Pi_2) - \Phi(\Pi_3), \\
 P(N^* = 3) &= \Phi(\Pi_3) - \Phi(\Pi_4), \\
 P(N^* = 4) &= \Phi(\Pi_4) - \Phi(\Pi_5), \\
 P(N^* = 5) &= \Phi(\Pi_5) - \Phi(\Pi_6), \\
 P(N^* \geq 6) &= \Phi(\Pi_6),
 \end{aligned}$$

where Φ is the distribution function of a standard normal random variable.

3.2 Functional Form Assumptions

Following Bresnahan and Reiss (1991), we assume that expected profits can be decomposed into variable profits and fixed costs and that variable profits can be written as multiplication of market size, i.e. the number of children in the market, and per child variable profits. Expected profits for a potential firm from entry to a market with N rival firms are:

where N represents market size, π per child variable profits, and F fixed costs. \mathbf{X} is a set of market size variables. \mathbf{Z} contains a set of market

²³In this model, the variance of the error term is not indentified and is normalized to one, as most other entry models do.

characteristics variables that affect variable profits, and α is a vector of market characteristics that shift fixed costs. Both variable profits and fixed costs are assumed to depend on the number of entrants.

Market size, variable profits, and fixed costs are approximated and parameterized by the following linear functions. The market size function, $V(N, X_V; \beta_V, \alpha)$, is specified as:

In addition to child population, child population growth rate and relative market size of adjacent markets are included to control for market heterogeneity that affects how firms percept the market size.

Variable profits and fixed costs are specified as:

$$V(N, X_V; \beta_V, \alpha) = X_V \beta_V + \sum_{n=1, \dots, N} \alpha_n$$

$$F(N, X_F; \beta_F, \gamma) = X_F \beta_F + \sum_{n=1, \dots, N} \gamma_n,$$

where β_V and β_F are parameters to be estimated. Parameters, α and γ , capture the industry specific changes in variable profits and fixed costs over market structures. This framework assumes α and γ do not vary across markets.

There are a number of possible reasons additional entrants affect variable profits and fixed costs. First, a later entrant may have higher costs in either variable or fixed costs or both. This is maybe because later entrants have lower efficiency or because high switching costs make it difficult for later entrants to acquire demand. Second, there may exist barriers to entry for later entrants. This is supposed to affect fixed costs, if any. Third, entry intensifies competition. This may be price or quality competition. In either case, this is supposed to reduce variable profits. As the profit function is specified as a reduced-form linear function, it is not possible to directly distinguish these three causes. The estimates of the parameters, α_n and γ_n , in variable profits and fixed costs, however, may provide information we can utilise to make inference on the competition environment of the industry. For example, while homogeneous good Bertrand price competition predicts variable profits suddenly decline after the second entrant, highly competitive markets and markets with full collusion predict stable variable profits over the number of entrants.

We estimate a generalised ordered probit model in which the dependent variable is the number of firms in a market. The latent variable equation we estimate is:

$$\Pi_N = \left(X_V \beta_V + \sum_{n=1, \dots, N} \alpha_n \right) \cdot S(X_S; \beta_S) - \left(X_F \beta_F + \sum_{n=1, \dots, N} \gamma_n \right)$$

for $N=1, 2, 3, 4, 5$, and 6 where N denotes the number of firms in the market. The

parameter estimates are obtained by the following maximum likelihood procedure:

$$(\alpha, \beta, \gamma) = \arg \max_{(\alpha, \beta, \gamma)} \sum_m \ln \Pr[N^* = N_m^o | X_m; \alpha, \beta, \gamma]$$

where $X_m = [X_{Sm}, X_{Vm}, X_{Fm}]$, the subscript represents market , and is the observed number of entrants in market .

3.3 Entry Thresholds

After the parameter estimation, we calculate entry thresholds. It is a minimum size necessary to maintain firms in a market, and it is calculated by setting the profits of N th firm to zero, namely:

$$0 = \Pi_N = \left(X_V \beta_V + \sum_{n=1, \dots, N} \alpha_n \right) \cdot S(X_S; \beta_S) - \left(X_F \beta_F + \sum_{n=1, \dots, N} \gamma_n \right)$$

This gives us

$$S(X_S; \beta_S) = \frac{(X_F \beta_F + \sum_{n=1, \dots, N} \gamma_n)}{(X_V \beta_V + \sum_{n=1, \dots, N} \alpha_n)}$$

The entry threshold child population for entrants can be evaluated by:

$$S_N = \frac{(\bar{X}_F \hat{\beta}_F + \sum_{n=1, \dots, N} \hat{\gamma}_n)}{(\bar{X}_V \hat{\beta}_V + \sum_{n=1, \dots, N} \hat{\alpha}_n)} - [\text{other market size variables}] \hat{\beta}_S,$$

where a bar over a variable denotes the sample mean and a circumflex denotes the corresponding maximum likelihood estimate. *Per firm entry thresholds* are obtained by dividing the threshold by the number of firms, namely, This measures break even market size for each firm when there are N firms in a market. We can test

whether the estimated entry thresholds reflect systematic differences among entrants, by testing whether per firm entry thresholds remain unchanged as N increases, i.e. testing the null hypotheses that $\frac{s_{N+1}}{s_N} = 1$. (Similarly, we can also test $\frac{s_{N+1}}{s_N} > 1$, $\frac{s_{N+1}}{s_N} < 1$, and so on.)

To illustrate how entry thresholds change as N increases, we define the *entry threshold ratio* as $\frac{s_{N+1}}{s_N}$. This is the rate of change in the per firm entry threshold as the number of firms increases by one. Bresnahan and Reiss (1991) claim that this ratio is greater than or equal to one and decreasing in N . If a market is highly competitive and each firm has no market power, the entry threshold ratio is expected to stay near one. Likewise, if each entering firm enjoys the same market power as every other firm, the entry threshold ratio will again stay near one. Bresnahan and Reiss (1991) found that in most industries they analysed, the entry threshold ratio significantly declines as the second and third firms enter, and stay slightly above one after the third firm.

4 Data

4.1 Counts of Childcare Centres

Data on the number of childcare providers, or N in the model, are based on information pertaining to the postcode location, the year of opening, and accreditation

status history of childcare providers that were operating as in May of 2006. This information was obtained from the website of the National Childcare Accreditation Council (NCAC) – the federal agency administering the CCQA system. Using the retrospective information, we counted the number of providers operating within each postcode area for each year during the study period, from 2001 to 2006. The resulting number of childcare providers closely approximates the number of providers reported by the NCAC (2006b) to be participating in the CCQA system for the analysis period (Fig.1). Both figures indicate an increase in the number of childcare providers, rising from 4058 in 2001 to 5043 in 2006 (the NCAC report).²⁴

In order to exploit the accurate measurement of the number of childcare providers, we use a postcode area as a unit of observation in this study, because without the information on the exact address of each provider, analysis at a different geographic level, such as Statistical Local Area (SLA), would require an approximation of the number of childcare providers.

²⁴It is possible that the number of providers used in this paper is underestimated because the data do not include providers that once operated but closed before May of 2006 when the original information was collected. However, the deviation of our estimate from the number reported by the NCAC is less than 5 percent for each year during the analysis period. Other possible sources of the deviation of our data from the NCAC data are the differences in the definition and the timing of data collection. We include providers that are 'Non Compliant,' which might be excluded in the NCAC data of 'participating services.' We count the number of providers as of December for 2001-2005, while the NCAC data indicate the availability as of June in each year. In addition, a very small proportion of providers were excluded because their location was unidentified. These cases used postcodes that were reserved for non-standard use such as PO Boxes.

4.2 Selecting Isolated Markets

Following the existing entry literature, our analysis focuses on a subset of the postcodes that can be reasonably regarded as a single isolated market. This is important because, to analyse competition environments of oligopolistic firms, a market needs to be well-defined. It would be ideal if each market were a geographical area where the entire market is covered by all the providers in the area (no within-market segregation) and it is served by only the providers in the market (no interaction with adjacent markets). However, the use of appropriate markets is particularly challenging in the case of the childcare industry, because it is quite common that parents travel to different areas for childcare, which violates the condition of no interaction with adjacent markets.

We choose isolated markets by using information about adjacent markets. Specifically, our entry analysis uses the postcode areas that satisfy the following conditions: (1) larger than 10 square kilometres; (2) smaller than 3,000 square kilometres; (3) satisfying either that there is no adjacent area or that the number of children aged 0 to 4 in the area is at least as twice large as the sum of the numbers of children in all the adjacent postcode areas; and (4) larger than 50 square kilometres including all the

adjacent areas if there is any adjacent area. The first and second conditions are used to exclude postcode areas with extreme size that we cannot regard as an isolated market. 37 percent of the postcode areas are excluded as not satisfying (1) or (2). For a postcode area that does not have an adjacent postcode area to be in the sample, these two conditions need to be met. For areas that have an adjacent postcode area (most postcode areas fall in this category), we need further conditions so as to focus on isolated markets, which motivates the third condition. This condition requires markets in our sample to have market size considerably larger than that of adjacent markets in terms of child population. At the same time, in the areas that satisfy the third condition, adjacent postcode areas may be too small to provide sufficient information to identify an isolated market, in which case customer flow from areas to areas that are further beyond adjacent areas may be a part of demand. This motivates the last condition, which guarantees that area within a certain radius from the centre is always contained in the observations in our sample.

The market size we use in this study is the number of children aged 0 to 4. The total number of children in adjacent areas is in most cases constructed as the simple sum of children in all adjacent areas, but if a postcode area or one of its adjacent areas is considerably geographically large, adjacent markets can be seen as a different market.

In such cases, we make adjustment by only counting a part of children in adjacent markets. The detail of this adjustment is provided in Appendix A.

The market size in some postcode areas indicates that those areas are likely to be out of the scope of our analysis. We further exclude the following postcode areas. First, in areas with extremely small or extremely large market size, the structure of competition and customer flow may be different. Based on this consideration, areas with less than 20 children in any year between 2001 and 2006 are excluded from the analysis. We also exclude areas with more than 2,000 children, which often have more than ten childcare providers and are out of the scope of our oligopolistic market analysis. Second, non-standard postcodes, such as postcodes for hospitals, universities, P.O. boxes, and sparse small islands, are dropped. Lastly, very few observations with missing values and missing adjacent market information are excluded. Table 1 reports the number of observations that do not satisfy each of these requirements. As a result, our sample consists of 1,209 year-postcode observations.

4.3 Market Size Variables

The market size, S in the model, is measured by the number of children aged 0 to 4, given that the revenue of childcare centres is based on the number of children, not the

number of parents. The number of children is extracted from the 2001 and 2006 Australian Censuses (collected by ABS) for each area defined by the 2006 SLA.²⁵ The relevant concordance files (provided by ABS) were used to convert the number of children from the 2006-SLA-level information to the 2006-postcode-level information, and the data for years between 2001 and 2006 were interpolated (see Appendix B for sources of data discussed in this section).

Tables 2, 3, 4, and 5 report the distribution of the national population and our sample. HERE EXPLAIN EACH TABLE. EXPLAIN WHAT TYPE OF MARKETS WE ARE LOOKING AT. FOR EXAMPLE, Talk about under-representation of major cities, etc.

Figures 2 and 3 show the average market size and the per firm average market size by the number of operating childcare centres in a market, respectively. The two lines represent the average size for national population and for the sample used for our analysis. [TALK ABOUT THE DIFFERENCE]

²⁵A Statistical Local Area (SLA) is a geographical area containing several Census Districts (CDs). As of 2001, there were 1353 SLAs, which contained 37,209 CDs, in Australia. An urban CD had about 220 dwellings, while the number for a rural CD depended on population density (Australian Bureau of Statistics, 2001).

In the following analysis, we further include two variables that may affect the recognition of the market size by firms – the growth rate of the number of newborn children over the past four years and the relative market size of adjacent postcode areas. The growth rate of the newborn may affect the entry decision of firms as a proxy for the future profitability of the market that affects. The relative market size of adjacent postcode areas is constructed as the ratio of the total number of children in all the adjacent areas to the number of children in the market. As discussed above, to focus on isolated markets, the following analysis uses the markets that take a value of 0.5 or less for this relative market size variable. When the market has a dominating market size relative to its adjacent areas, children in the adjacent areas may cross the border for childcare centres in the market. Hence, this relative market size variable may capture a potential inflow of demand (but not outflow) and is included in the market size function.

4.4 Market Characteristics Variables

We use market characteristics to explain variable profits and fixed costs (X_V and X_F , respectively). All variables are defined at the postcode area level. First, we include variables indicating socio-economic and demographic characteristics of consumers which are likely to affect their probability of using centre-based childcare, and thus