EFFECTS OF INFORMATION PROVISION IN A VERTICALLY DIFFERENTIATED MARKET

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ABSTRACT

In this paper, we study the effects of consumer information on equilibrium market prices and observable product quality in the market for child care. Child care markets offer a unique opportunity to study these effects because of the existence of resource and referral agencies (R&Rs) in some markets. R&Rs provide consumers with information on availability, price, and observable characteristics of care. To understand the effects of information provision in markets like child care, which exhibit a distribution of product quality, we examine the effects of information provision in a model of vertical differentiation. We show conditions under which increased consumer information reduces price dispersion, maximum price, and average price. With guidance from this model, we examine empirically the effects of R&Rs on the distribution of child care prices. We also consider the effects of R&Rs on the distribution of staff-child ratios.

We estimate separate models for the distribution of prices and staff-child ratios for infants, toddlers, preschoolers and school age children because of regulatory and care differences across age groups. We find that R&Rs have economically large and statistically significant effects on the distribution of prices for the care of infants and toddlers. Geographic markets with R&Rs have significantly less price dispersion and lower maximum prices. There is also some evidence that markets with R&Rs have lower average prices. Information provision via R&Rs has no significant effects on staff-child ratios. These findings are generally consistent with search theory and support the contention that information provision can intensify price competition.

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1. Introduction

The market for child care is characterized by vertical differentiation and asymmetric information between buyers and sellers, where buyers incur substantial search costs to learn about variations in prices and care characteristics. Such informational imperfections are common to many markets and have fundamental implications for how product markets function.[1]

Despite the prevalence of informational imperfections, there is only limited understanding of the effects of information provision in vertically differentiated markets. The theoretical literature primarily considers the effects of information in markets with homogenous products.[2] In vertically differentiated markets like child care and health services, there exists a distribution of product quality. The empirical literature considers the impact of information provision by advertisements. Advertising may affect equilibrium by providing information (informative advertising), but it may also engender brand loyalty.[3]

In this paper, we study the effects of centralized information provision in a vertically differentiated market. We develop a model with features that reflect some important aspects of markets for child care and health services (e.g. product heterogeneity, search costs, and heterogeneous tastes for quality). We compare the functioning of such markets when there is imperfect information and when there is full information. We are able to show that the primary effect of information provision will be to decrease price dispersion. Information provision may also lower prices, but this requires strong willingness to search on the part of consumers who value product quality highly.

We then exploit a unique feature of child care markets and a unique data set to examine empirically the effects of information provision by public and not-for-profit agencies. In some child care markets, Resource and Referral agencies (R&Rs) provide a centralized source of information on location, price, and observable characteristics of child care. R&Rs are generally grass roots, not-for-profit organizations whose primary function is to help parents find appropriate child care for their children. Consumers in markets with R&Rs can reasonably be assumed to have better information or lower search costs than consumers in markets that are not served by R&Rs. We study the effects of R&Rs on market outcomes using data from a diverse number of sources,

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[1] J. Stiglitz, "Imperfect Information in the Product Market," *Handbook of Industrial Organization*, (New York, NY: North Holland, 1989), pp 843-4.

[2] See for example, Benabou (1988), Diamond (1987), Rob (1985), and J. Reinganum (1979).

[3] For example, Benham (1972) finds that states which allow advertising have lower prices for eyeglasses and eye examinations. Similarly, Kwoka (1984) finds that advertising lowers the price of optometric services. However, Nelson, Siegred and Howell (1992) find that advertising allows firms to raise coffee prices.

including firm-level data from a nationally representative sample of child care centers, various compilations of child care policy variables, and two special surveys carried out for this project.

To determine the effect of R&Rs on the distribution of market prices, we define local child care markets. We partition centers into local geographic markets based on proximity in driving distance. Within each market, we obtain a price distribution and compute average price, maximum price, and the coefficient of variation for the price distribution. We regress these descriptors of local price distributions on a binary reflecting the presence of an R&R and other variables in the reduced form implied by a market model for child care.

Information provision can have differential effects on markets for the care of children of different ages. Information imperfections are greater for younger children, who can provide less information on the type of care received than older children. Moreover, parents of older children are more likely to be familiar with care options in their local area, as they are more likely to have used child care in the past. To allow for possible differential effects of information across age groups, we separately study markets for the care of infants, toddlers, preschoolers, and school-age children.

Our results provide support for the contention that the provision of information by not-for-profit or public agencies will impact the distribution of prices only when information asymmetries are substantial. To be more specific, we find that the dispersion of prices and the maximum observed price for the care of infants and toddlers are significantly lower in markets with R&Rs than in markets that do not have these information-providing agencies. By way of contrast, markets with and without R&Rs have virtually identical price distributions for the care of preschoolers (3 to 5 year old) and school-age children.

While neither theory nor empirical work indicates that information provision will have its major impact on quality, we felt it important to examine the impact of information provision on quality. The decreases in prices and lessened price dispersion for younger children that we observe to be associated with centralized information provision may only be beneficial if they are not associated with lowered quality. When firms compete in both price and costly quality, information provision that decreases price dispersion generally increases price competition. Firms may respond to the increased price competition by altering the quality of the products they provide.[4] To explore the impact of information-induced decreases in price dispersion on quality, we estimate a reduced form model for the most widely followed observable measure of child care quality, the staff/child ratio. We find that markets with R&Rs have distribution of staff/child ratios that are insignificantly different from areas

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[4] Ronnen (1991) provides an analysis of the effects of intensified price competition on location choices in the quality spectrum.

without R&Rs. We, of course, can say nothing about measures of quality that we do not observed (e.g., the environment of the care setting or the nature of the interaction between caregiver and child).[5]

We conclude that publicly or privately supported information provision can have beneficial effects. Most directly, information provision lowers consumer search costs. Both our theoretical and empirical work indicate that information provision can reduce price dispersion without eroding an important measure of observable quality.

The outline of the paper follows. In the next section, we describe important features of child care markets. In section 3, we develop our theoretical model, and in Section 4, we describe our data and empirical methodology. Section 5 contains a discussion of the impact of R&Rs and other factors on the distribution of market prices. Section 6 contains a discussion of the impact of R&Rs on the distribution of staff-child ratios. The final section contains our summary and conclusions.

2. The Market for Child Care

Unique features of child care markets allow us to examine the effects of information provision.[6] These markets are very localized, because parents overwhelmingly prefer to have their children cared for in their own residential neighborhood (Maryland Committee for Children, 1996; Queralt and Witte, forthcoming). Care providers compete in both price and costly quality. Families incur substantial search costs to learn the prices and care characteristics of providers.

Beginning in the late 1960s, various grassroots community organizations in higher income, better educated areas began collecting information on child care prices and measurable aspects of child care quality (e.g. staff/child ratios). These groups, typically called Information and Referral agencies, made this information available to parents either free of charge or for a small fee. As the importance of female workers increased during the 1970s, many corporations became interested in helping their employees obtain child care. By the late 1970s and 1980s, corporations began to actively engage in expanding the availability of child care and to retain the services of the Information and Referral agencies to assist their employees. By the end of the 1980s, Resource and Referral agencies (R&Rs), as they came to be called, had spread widely. In 1990, the year of our data, over

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[5] Akerlof (1979) studies the effects of intensified price competition on unobservable quality, and Kwoka (1984) empirically studies the effects of informative advertising on the quality of eye examinations.

[6] For a recent description of the economics of child care, see Council of Economic Advisors (1997).

half of local areas in the U.S. had R&Rs. Descriptive statistics in Table 1(a) show that in 1990, R&Rs were still most common in higher income and better educated areas.

R&Rs maintain and continually update their databases on prices, availability of care, and care characteristics for all centers (licensed and license exempt), licensed family day care homes, and some unlicensed family day care homes in their geographic areas. They provide most of their information via telephone, in response to parent inquires. Though different R&Rs offer different services, their central functions are to provide referrals and child care information and to counsel parents on strategies to find safe, convenient, and affordable care.[7] The presence of R&Rs in some local areas, but not in others, allows us to examine the effect of a central source of market information on market outcomes.

Centers compete with family child care homes, particularly for the care of young children (infants and toddlers) and school-age children. Both centers and family day care homes are subject to state and sometimes local regulations. State and local regulations specify minimum staff/child ratios and maximum group sizes by age of child. Centers are also subject to training requirements and minimum square footage requirements. They may also be required to carry liability insurance. Regulations are enforced by inspection.

In this paper, we focus on child care centers, the largest providers of non-parental care.[8] Child care centers are best conceived of as multi-product firms, because children of different ages require quite different types of care. For example, preschoolers require supervision and developmental activities while infants require more basic care (e.g. changing diapers and feeding). Care for younger children is generally more labor intensive while care for older children requires more indoor and outdoor space. Consistent with this observation, centers maintain staff/child ratios for infants that are approximately half of those maintained for school-age children. See Table 1(a). Further, informational asymmetries are greater for younger than for older children. Older children are able to provide parents with far more useful and complete information on the type of care they receive. To overcome these substantial information problems, parents may search more thoroughly for the care arrangements of younger children than for care arrangements of older children. In addition, state and local regulations governing centers are different for different age groups, being more stringent for younger children.

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[7] See Magenheim (1992) and Adams, Foote and Vinci (1996) for more detailed descriptions of these agencies.

[8] There are primarily two types of non-parental care providers: centers and family day care homes. Centers care for large numbers of children in institutional settings while family day care homes care only for three or four children in a home setting. Family day care homes are owner operated, while centers come in a wide variety of institutional forms (e.g. corporate chains such as Kinder Care and not-for-profit entities). Centers usually group children according to age while family providers mix children of all ages. Family day care homes and centers are also subject to different sets of regulations. Because they are very different entities, we examine centers separately from family day care homes. However, because they are reasonable substitutes for child care, we control for the effects of family regulations on outcomes in our empirical specifications.

To account for these structural differences in market forces across age groups, we study the effect of R&Rs separately for infants, toddlers, preschoolers, and school-age children.

3. Model

To understand the effect of R&Rs on the distribution of prices for child care centers, we develop a model of search for a market with vertical differentiation. Reflecting the stylized facts of child care markets, consumers are imperfectly informed about both prices and product quality in our base model. We determine equilibrium prices and determine the average price, the maximum price and the dispersion of prices for this model. For comparison purposes, we also derive expressions for the average price, the maximum price and the dispersion of prices when parents are fully informed about both prices and the quality of available products. To determine the effect of information on prices, we compare the distribution of equilibrium prices when information is imperfect with the distribution of prices when parents are fully informed. We show conditions under which better information reduces price dispersion, maximum price, and average price.

To develop a model that reflects important aspects of the child care market, we draw upon the theoretical literature on the effects of information on market outcomes (Reinganum (1979), Butters (1979), Rob (1985), Schwartz and Wilde (1985), Chan and Leland (1986), Diamond (1987), Benabou (1988) and Stiglitz (1989)) and the literature on quality differentiation in monopolistically competitive markets (Gabszewicz and Thisse (1979), Shaked and Sutton (1982), and Ronnen (1991)). As is standard in the literature, we focus on the effect of information on the average price, maximum price and the dispersion of prices. We assume that consumers search over price and quality and that markets are monopolistically competitive.[9]

We adopt the basic features of models commonly used to study quality differentiation in monopolistically competitive markets. The supply side of the market consists of two firms producing quality-differentiated goods and engaging in price competition. As in Gabszewicz and Thisse (1979), we assume that each firm offers exactly one exogenously chosen quality level, with $q_L < q_H$. Firms face the same quality-dependent cost of production. The low quality firm has marginal cost c_L and the high quality firm has marginal cost c_H, where $c_L < c_H$.

[9] Our treatment of search costs differs from the existing literature in a number of ways. Important differences are that Reinganum (1979), Butters (1979), Rob (1985), Diamond (1987), and Benabou (1999) consider markets with homogenous goods. Here, as is appropriate for child care markets, we consider markets with quality differentiation. Also, Schwartz and Wilde (1985) and Chan and Leland (1986) consider markets with perfect competition at each quality level. Because child care providers face quality-dependent fixed costs, we consider markets with monopolistic competition.

The demand side of the market consists of a continuum of consumers indexed by taste parameter θ and uniformly distributed on [0,1]. We follow Rob (1985), Schwartz and Wilde (1985), and Chan and Leland (1986) and assume that consumers have different levels of willingness to search. In child care markets, parents' willingness to search may vary with tastes and preferences, the perceived vulnerability of the child, the opportunity cost of time spent searching, the out-of-pocket costs of search, and the parents' ability to process information. For simplicity, we assume that search costs, denoted τ, can take one of two values: τ_L for parents with high willingness to search (i.e. low search costs) and τ_H for parents with low willingness to search (i.e. high search costs). Parents decide whether or not to buy, making no purchase or else buying from exactly one of the firms in the market. The value a consumer of type θ places on quality level q is $v(q,\theta) = \theta q$. The surplus of consumer θ who purchases quality q and pays price p is therefore given by $\theta q - p$.

A. Equilibrium with Imperfect Information

As in Gabszewicz and Garella (1987) we assume that at the start of their decision making process, consumers know only the average price and average quality level in the market.[10] Each consumer searches at least once, with an equal chance of arriving at either the high or low quality provider. Upon arriving at the first provider, the consumer obtains full information. The consumer then decides whether to drop out of the market, whether to stay and purchase at the first provider, or whether to go to the other provider. Going to the second provider requires a transaction or search cost of τ_θ. As argued earlier, τ_θ may vary with the consumer's type either because consumers have different willingness to bear the time and money costs of additional search or because time and money costs of search vary across consumers. Here, we assume that there are only two levels of willingness to search: τ_H and τ_L, where $\tau_\theta = \tau_H$ if $\theta < A$, $\tau_\theta = \tau_L$ if $\theta \geq A$, and $A = \dfrac{p_H - p_L}{q_H - q_L}$.[11]

With probability ½, consumers arrive first at the low quality provider. These consumers will buy from the low quality provider if and only if $\theta q_L - p_L > \theta q_H - p_H - \tau_\theta$ and $\theta q_L - p_L > 0$, or equivalently:

$$\frac{p_L}{q_L} \leq \theta \leq \frac{p_H - p_L + \tau_H}{q_H - q_L} \equiv A_L \qquad \textbf{(1)}$$

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[10] Gabszewicz and Garella (1987) study the effects of search in a market with horizontal differentiation. The main difference between our two models is that without search costs, their firms charge a single uniform price, whereas our firms continue to charge different prices.

[11] What we require is that $\tau_\theta = \tau_H$ for θ sufficiently low and that $\tau_\theta = \tau_L$ for θ sufficiently high. Here, the cutoff A is chosen for convenience and is treated as an exogenous parameter. More formally, we may have chosen a $\theta_0 \in [A - \tau_L/(q_H - q_L), A]$ as our cutoff, where θ_0 is an exogenous parameter.

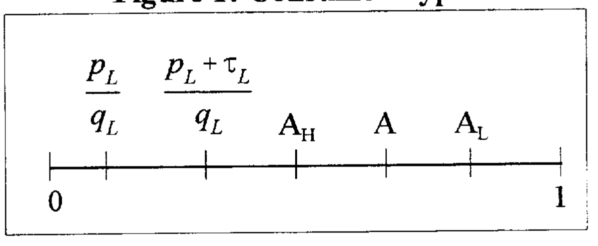
Consumers with $\theta < \frac{p_L}{q_L}$ do not purchase child care, and those with $\theta > A_L$ locate and buy from the high quality firm.

With probability ½, consumers arrive first at the high quality provider. These consumers buy from this provider if and only if $\theta q_H - p_H > \theta q_L - p_L - \tau_\theta$ and $\theta q_H - p_H > 0$, or equivalently if:

$$\theta \geq \max\{A_H, \frac{p_H}{q_H}\}, \textit{ where } \frac{p_H - p_L - \tau_L}{q_H - q_L} \equiv A_H \tag{2}$$

We assume, for simplicity, $\max\{A_H, \frac{p_H}{q_H}\} = A_H$.[12] Consumers with $\theta < A_H$ drop out of the market if $\theta q_L - p_L - \tau_\theta < 0$ or equivalently, if $\theta < \frac{p_L + \tau_L}{q_L}$. Consumers with $\frac{p_L + \tau_L}{q_L} < \theta < A_H$ locate and buy from the low quality firm. Figure 1 depicts consumer valuations and cutoffs.

Figure 1: Consumer Types



Imperfect information reduces market participation because consumers must bear search costs as well as direct care costs in order to obtain care for their children. As shown in the next section, when consumers have full information, consumers with $\theta < \frac{p_L}{q_L}$ do not participate in the market. With imperfect information, these consumers remain out of the market. However, additional consumers drop out as well. To be precise, those consumers who value quality lowly but by chance wind up first at the high quality provider, i.e. with probability ½, $\theta \in [\frac{p_L}{q_L}, \frac{p_L + \tau_L}{q_L}]$, also do not participate in the market.

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[12] Alternatively, if $\max\{A_H, \frac{p_H}{q_H}\} = p_H$, the high quality firm's expected demand would not increase by as much. While we do not present this case in the paper, we point out that it does not alter the spirit of our conclusions. We can still derive conditions, though they are more stringent, under which the presence of search costs raises price dispersion, maximum price, and average price.

To solve for the Nash equilibrium in prices, we determine expected market shares for each firm. Expected market shares for the low and the high quality firms, respectively, are:

$$ES_L = \frac{1}{2}(A_L - \frac{p_L}{q_L}) + \frac{1}{2}(A_H - \frac{p_L + \tau_L}{q_L}) \quad \text{and} \quad ES_H = \frac{1}{2}(1 - A_L) + \frac{1}{2}(1 - A_H).$$

Each firm chooses price by maximizing expected profits, which are obtained by multiplying the price cost margins by expected market share. Equilibrium prices are:

$$p^*_{L,S} = \frac{2q_H c_L + q_L c_H + q_L q_H - q_L^2}{4q_h - q_L} - \frac{q_L(\tau_H - \tau_L) + 2\tau_L(q_H - q_L)}{2(4q_H - q_L)} \qquad \textbf{(3)}$$

$$p^*_{H,S} = \frac{c_H}{2} + \frac{q_H - q_L}{2} + \frac{1}{2}\left(\frac{2q_H c_L + q_L c_H + q_L q_H - q_L^2}{4q_h - q_L}\right) + \frac{(2q_H - q_L)(\tau_H - \tau_L) - \tau_L(q_H - q_L)}{2(4q_H - q_L)} \qquad \textbf{(4)}$$

B. Equilibrium with Perfect Information

Next consider the situation where consumers costlessly observe the price and quality of the product offered by each firm prior to making their purchases. Given the firms' price-quality combinations (q_i, p_i), $i = L, H$, each consumer chooses whether to consume. The consumers that decide to purchase also choose from which firm to buy. Firms set prices, taking as given their rivals' price, quality levels, and consumer valuations.

As before, to solve for the Nash equilibrium in prices, we derive market shares for each firm. The marginal consumer who is indifferent between q_H at price p_H and q_L at price p_L is given by: $\theta = \frac{p_H - p_L}{q_H - q_L} \equiv A$. Similarly, the marginal consumer who is indifferent between purchasing q_L and making no purchase has a valuation of: $\theta = \frac{p_L}{q_L}$. Thus, the market share for the high quality firm is 1 - A and that for the low quality firm is $A - \frac{p_L}{q_L}$.

Each firm chooses price to maximize profits, which are found by multiplying price-cost margins by market share. Equilibrium prices are given by:

$$p^*_H = \frac{c_H}{2} + \frac{q_H - q_L}{2} + \frac{1}{2}\left(\frac{2q_H c_L + q_L c_H + q_L q_H - q_L^2}{4q_h - q_L}\right) \qquad \textbf{(6)}$$

$$p_L^* = \frac{2q_H c_L + q_L c_H + q_L q_H - q_L^2}{4q_h - q_L} \qquad (5)$$

Prices are increasing in both own and rival's marginal costs. Prices also increase as quality differentiation increases. If there is no quality differentiation, $q_H = q_L$, $p_H^* = p_L^* = c$, and profits for each firm equal zero. If we were to allow firms to choose quality levels in the first stage of a two stage game, firms would choose to differentiate themselves from each other in order to soften subsequent price competition. In markets with quality differentiation, both firms will earn positive profits at least large enough to cover fixed costs. Under our model, market forces will lead to product differentiation. This replicates an important aspect of the child care market.

C. Comparison

We now turn to a comparison of equilibrium prices with imperfect information and those with full information. Following the literature, we focus attention on three characteristics of the price distribution: price dispersion, maximum price, and average price. Because our model contains two firms, price dispersion is measured as the difference between the high and the low price. Change in price dispersion due to search is given by:

$$p_{H,S} - p_{L,S} - (p_H - p_L) = \frac{2q_H(\tau_H - \tau_L) + \tau_L(q_H - q_L)}{4q_H - q_L}. \qquad (7)$$

Thus, the following proposition is immediate:

Proposition 1 If $\tau_H \geq \tau_L$, markets with imperfect information will have more price dispersion.

For $\tau_H \geq \tau_L$, consumers who do not value quality highly must have a lower or equal willingness (i.e. higher or equal search costs) to continue searching than consumers with higher valuations for quality. To put it somewhat differently, consumers who value quality highly are weakly more inclined to keep searching until they obtain a good match than are consumers who have lower valuations for quality. Alternatively, lower valuation consumers must be more inclined to either drop out of the market or stay at the first provider they encounter.

When $\tau_H \geq \tau_L$, the high quality firm has a higher expected demand when information is imperfect than when there is full information. Under imperfect information, the high quality firm continues to serve all high valuation consumer in the interval [A, 1], as it did under perfect information. Now, this firm will also serve some lower valuation consumers, in the interval $[A_H, A]$, who happen to find the high quality firm first (see Figure 1). The low quality firm has a lower expected demand when information is imperfect. It loses some consumers in the interval $[A_H, A]$ and some in the interval $[\frac{p_L}{q_L}, \frac{p_L+\tau_L}{q_L}]$. The low quality firm captures these consumers when information is perfect.

As a result of lower expected demand, the low quality firm charges a lower price when information is costly to obtain than when it is freely available. Equation (7), which is unambiguously positive for $\tau_H \geq \tau_L$, shows that the high quality store either raises its price or does not lower by as much as the decrease in the low quality price. Consequently, we have the result that markets with imperfect information will have more disperse prices.

Change in the maximum price due to search is given by:

$$p_{H,S} - p_H = \frac{(2q_H - q_L)(\tau_H - \tau_L) - \tau_L(q_H - q_L)}{2(4q_H - q_L)}, \quad \textbf{(8)}$$

After some algebra, we have the following proposition:

Proposition 2 If $\tau_H > \left(\frac{3q_h - 2q_l}{2q_H - q_L}\right)\tau_L$, imperfect information results in increased price dispersion and higher maximum price.

This result stems from the conflicting pressures on the high quality firm's price. On the one hand, the high quality firm tends to charge a higher price because it faces higher expected demand under imperfect information than in a market with full information. On the other hand, it tends to charge a lower price as a strategic response to its rival, the low quality firm, which is charging a lower price due to lower expected demand. In order for the higher expected demand effect to dominate the strategic price response, high valuation consumers' willingness to search must be sufficiently higher than the low valuation consumers' willingness to search so that the high quality firm's expected demand rises by enough to result in a price increase.

Change in the average price due to search is given by:

$$\frac{p_{H,S} + p_{L,S}}{2} - \frac{p_H + p_L}{2} = \frac{2(q_H - q_L)(\tau_H - \tau_L) - 3\tau_L(q_H - q_L)}{2(4q_H - q_L)}. \quad \textbf{(9)}$$

After some algebra, we have the following proposition:

Proposition 3 If $\tau_H > \frac{5}{2}\tau_L$, imperfect information results in increased price dispersion, higher maximum price, and higher average price.

In order for search costs to raise average market price, the increase in the high quality firm's price must be large enough to more than offset the decrease in the low quality firm's price. The high quality firm's price can only increase by enough if high valuation consumers are willing to search substantially more than lower valuation consumers. Indeed, high valuation consumers have be more than twice as willing to search as low valuation consumers in order for average prices to fall. It is straightforward to prove that if the condition for Proposition 3 is satisfied, so are the conditions for Propositions 1 and 2.

To summarize, we have shown that the need for costly search affects equilibrium price distributions in vertically differentiated markets. With relatively few restrictions, we are able to show that prices will vary less when there is full information. Obtaining the result that maximum prices and average prices decrease with information requires stronger assumptions on the relative willingness to search of low and high valuation consumers. To be specific, willingness to search must be positively correlated with the valuation for quality in order for the maximum price and the average price to decrease with information provision. In the remainder of this paper, we use this theoretical framework to help interpret our empirical results.

4. Data and Methodology

To empirically study the effects of information provision in child care markets, we constructed a database for child care centers in 100 county/county groups representative of the U.S. We combined information from a number of sources: (1) the Profile of Child Care Settings (PCS), (2) the 1990 Census, (3) various compilations of state regulations, (5) a special survey by the National Governor's Association, and (5) special surveys of R&Rs and of local regulatory agencies carried out for this project.

Our firm-level data comes from the PCS.[13] The PCS contains data on 2039 centers chosen as representative of the US, which were interviewed using computer aided telephone interviewing.[14] For this study, we exclude Head Start centers and centers sponsored by public schools (Pre-Ks). Such centers generally charge zero or nominal prices and are mainly concerned with the development of low-income children rather than the provision of child care. Pre-Ks and Head Start centers generally operate on a part-year, part-day basis and are more responsive to the availability of public funding than to market forces.[15] We focus on the remaining 945 market-oriented centers.

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[13] Kisker *et. al.* (1991) provides a detailed description of the PCS.

[14] Since centers tend to be large, they are not able to operate in the informal or underground economy.

[15] Head Start and public school centers were over sampled and, hence, comprise a large fraction of the total sample.

For each center, the data include information on center location, center affiliation, profit status and other center-level data. The data also contain information on ages of children, prices and staff-child ratios at the group level for each group at each center. Such group-level or classroom-level data is rarely available for analysis.

As described in Section 2, the quality and price of child care varies markedly from provider to provider and parents often incur substantial search costs to obtain the care they want for their children. Over half of the counties in our sample are served by a R&R, providing a centralized source of information on the price, quality and location of child care providers. Our model indicates generally that markets with R&Rs should have prices that are less disperse than markets without R&Rs. If parents who highly value quality care have greater willingness to search than parents with lower valuations for child care quality, then markets with R&Rs may also have lower maximum and average prices. To empirically determine the effect of R&Rs on the distribution of equilibrium market prices, we need to define child care markets and we need to specify an empirical model that incorporates other determinants of observed price distributions.

4.1 Market Definition

The data on center location allows us to define local child care markets.[16] We partition our centers into geographic markets based on proximity to other centers in the sample. Using the five-digit zip code location of each center, we determine the distance in miles between centers. We define centers as belonging in the same market if a center is within a three-mile base radius of at least one other center in the market.[17] A base radius of 3 divides our sample of centers into 225 geographic markets, with an average number of 4 firms that are on average 2 miles apart. Since these firms are randomly drawn for each market, they should represent the distribution of prices and qualities available in the market.

We experimented with various market definitions from 3 miles to 20 miles. We also considered counties as possibly defining markets. We report results with base radii of 3 miles, which provide a sensible partition of our data in which large metropolitan counties are over-sampled. However, our results are robust to changes in market definition. Table 2 describes price distributions and Table 3 describes staff/child ratio distributions, across child age groups and for markets with and without R&Rs.

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[15] Ellen Kisker provided us with the zip code location of each center. Zip codes were not available in the public use tapes for the PCS.

[17] Miles are determined as the crow flies and do not account for the curvature of the earth.

4.2 Determinants of Observed Price and Quality Distributions

To structure our empirical work, we adopt a model of supply and demand for child care developed by Chipty and Witte (1994). For the purposes of this paper, we estimate the reduced form implied by this model. The estimation of a carefully specified reduced form increases our confidence in results we obtain for the effect of R&Rs on the distribution of prices.

Dependent Variables

The PCS provides detailed information on prices and staff/child ratios [18] for each group at a center. Prices vary with age of the child and with the period for which care is purchased (e.g., daily, weekly, monthly, annually). Centers generally supply care and quote prices on a weekly basis. To reflect this, we employ weekly prices in our analysis.[19] Centers generally have at least three distinct groups, and groups generally contain only children of specific ages. For each age group, we construct a center level measure of price and staff/child ratio using information for the groups that care for children falling in that age group. Units for prices are chosen to reflect the most frequent hours per day and days per week combination for each age category. PINFANT is the weekly price for the care of children that are less than a year old for five days a week and ten hours a day. PTODDLER is the weekly price for care for children between the ages of one and three, for five days a week, eleven hours a day. PPRESCH is the weekly price of care for children between ages three and six for five days a week and three hours a day. PSCHOOL is the weekly price of care for school-age children for five days a week three hours a day. If a center offers multiple packages for care of children of a particular age, the price for the age group is computed as the average price for that age group at the center. All prices are deflated by a regional cost of living index at the county level (American Chamber of Commerce, 1990).

Using the group level data, we also construct average staff-child ratio (ASCRATI, ASCRATT, ASCRATPS, and ASCRATS, for infants, toddlers, preschoolers, and school-age, respectively). Table 1 (a) presents descriptive statistics for the price and staff/child ratio variables at the center level and Table 2 and 3 presents descriptives at the market-level.

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[18] Some researchers consider staff-child ratios to be the single most important indicator of care quality (Helburn et. al. (1995), Clarke-Stewart (1987), Ruopp, Travers, Glantz, & Coelen (1979)). Moreover, it is widely believed that favorable ratios give parents assurance that teachers will have a better chance both to ensure that their children are safe from danger and to engage children in developmentally appropriate activities.

[19] Other studies that have used the PCS data employ hourly instead of weekly rates. However, we note that hourly rates and hourly care are rarely available.

Explanatory Variables

We obtain measures of exogenous demand-side factors affecting the price and quality of care offered by centers at the five-digit zip code level from the *1990 Census of Population* and from a special survey by the National Governors' Association (1990). Specifically, we include median family income (INCOME), fraction of children less than 13 who are less than one year old (FINFANT), fraction of children less than 13 who are between one and three (FTODDLER), fraction of children less than 13 who are three through five (FPRESCH), and fraction of children less than 13 who are school-age (FSCHOOL), fraction of children less than 13 in the population (PKIDS), population density (DENSITY), fraction of population college educated (COLLEGE), fraction of the population black (PBLACK), percent of males in labor force working full time (MALEWK) and a binary variable equal to one if the state allowed state taxes to be reduced for child care expenses (TAXDED).[20] Data on income is deflated by the regional cost of living index. Demographic variables are aggregated to the market level, to correspond to each of the center-market definitions described above.

We obtain measures for exogenous supply-side characteristics that may affect equilibrium prices and staff/child ratios from the PCS, the Census of Housing, various compilations of state regulations (Morgan 1986, 1993) and a special survey of local child care regulations that we conducted. Specifically, we include the percent of centers in the market that are for profit (PROFIT) and percent of centers that are part of a national or local chain (NLCHAIN), the median hourly wage of center teachers by county (WAGES) and the median contract rent per room (RENT) by county. Data on wages and rents are deflated by the regional cost of living index.

To specify the vector of regulatory variables included in the model we draw on previous work by Chipty & Witte (1994), Chipty (1995) and Chipty & Witte (1997). Specifically, we control for the following center regulations: whether liability insurance is required (INSURE), whether pre or in-servicing training is required for the staff (TRAIN), the minimum square feet of indoor space required per child (SQFEET), the maximum group size (GRSZ) by age, and the minimum staff-child ratio (SCRAT) by age. Since center behavior was found to be affected by the nature of regulations for family child care homes as well as by center regulations, we also control for the regulations imposed on family child care homes. Specifically, we control for the following family child care home regulations: maximum group size (FGRSZ) allowed, and whether pre or in-service training is required (FTRAIN). Finally, to reflect enforcement of regulations we include the number of inspections required per year for centers (INSPECT) and family child care homes (FINSPECT).

To complete the specification of our model, we needed to obtain information on whether or not an R&R was in operation in each of our markets. We approached a number of individuals prominent in the R&R world. A

[20] Some states allow a deduction and others grant a credit for child care expenses.

member of the executive board of the national R&R association, NACCRA, compiled data that allowed us to discern if an R&R existed in each of the 100 counties in 1990 when the PCS data were collected. We used these data to construct RANDR, a binary variable indicating whether or not an R&R existed in the local area in 1990.

Descriptive statistics are presented in Table 1. Table 1(a) contains summary statistics for most demand-side and supply-side characteristics. Table 1(b) contains summary statistics for the tax deductibility and regulatory variables.

5. Price Distributions

Recall that the model outlined in Section 3, provides predictions for the effect of search costs on the dispersion of prices, the maximum price in the market and the average price in the market. Calculation of the average and maximum prices is straightforward. We use the coefficient of variation as our measure of price dispersion. This is a commonly used measure of the relative dispersion of different distributions that does not vary with units of measurement. Table 3 presents summary statistics for each price distribution (PINFANT, PTODDLER, PPRESCH, PSCHOOL).

The raw data show that price dispersion increases with age. Moreover, these raw data show that markets with R&Rs tend to have greater price dispersion, higher maximum prices, and, higher average prices. These differences are surprising given most economic models, including our own. However, the differences may be explained by consumer demographics or input costs that are correlated with the presence of R&Rs. Table 1(a) shows that markets with R&Rs tend to have higher incomes, are more educated, have higher rents and are more urban than markets without R&Rs.

To control for other effects on the distribution of prices, we estimate the reduced form models described in the previous section. The explanatory variables are described in Section 4 and summarized in Table 1. The reduced form equations for the coefficient of variation are specified as:

$$COEFVAR_{pm} = \beta_{p10} + SUPPLY_{pm}\beta_{p11} + DEMAND_{pm}\beta_{p12} + RANDR_{m}\beta_{p13} + u_{pm} \qquad \textbf{(10)}$$

where m indexes the market and p indexes the product (care for infants, toddlers, preschoolers, or school-age children). The dependent variable is the coefficient of variation; the regressors SUPPLY, DEMAND, and RANDR are as described above; and u_{pm} is the random error. Note that in these market-level regressions, explanatory variables are the average value for the market. For example, the center level data includes a binary variable $NLCHAIN_{im}$ which is 1 if center i is part of a national or local chain, 0 otherwise. If market m contains five centers of which two belong to a chain, then the $NLCHAIN_{m} = 0.2$.

The coefficient of primary interest is that associated with RANDR. Recall from Section 3 that for the dispersion of prices to decrease with increased information, one of two conditions had to hold. Either parents who value quality highly are weakly more inclined to keep searching until they obtain a good match than are parents who have lower valuations of quality or parents who value quality in child care less must be more inclined to either drop out of the market or stay at the first provider they encounter.

Similarly, reduced form equations for maximum price and average price are specified as:

$$MAXP_{pm} = \beta_{p20} + SUPPLY_{pm}\beta_{p21} + DEMAND_{pm}\beta_{p22} + RANDR_{m}\beta_{p23} + e_{pm} \qquad \textbf{(11)}$$

and

$$AVGP_{pm} = \beta_{p30} + SUPPLY_{pm}\beta_{p31} + DEMAND_{pm}\beta_{p32} + RANDR_{m}\beta_{p33} + v_{pm} \qquad \textbf{(12)}$$

where $MAXP_{pm}$ is the maximum price for care in age group *p* in market *m*, and $AVGP_{pm}$ is the average price for care in age group *p* in market *m*. Note that under our model, better information will only result in lowered maximum and average prices if parents who highly value quality care for their children are sufficiently more willing to search for a good match than are parents with lower valuations for child care quality.

We separately estimate parameters for each of the three dependent variables, for each age group, using ordinary least squares.[21] Standard errors are heteroskedasticity robust. Results are presented in Tables 4, 5, and 6 for the coefficient of variation, maximum price, and average price, respectively. Adjusted R-squareds range from 0.141 to 0.719 in the coefficient of variation models, from 0.234 to 0.761 in the maximum price models, and from 0.186 to 0.634 in the average price model.

5.1 Coefficient of Variation

R&Rs significantly reduce price dispersion for infant and toddler care. Thus, we find that controlling for socio-demographics and market characteristics reverses the pattern observed in the raw data. The table below summarizes predicted effects along with standard errors, for markets with and without R&Rs. The presence of R&Rs reduces price dispersion by 75%, from 0.317 to 0.081, in markets for infant care, and it reduces price

[21] In previous drafts of this paper, for each age group, we estimated the three equations (coefficient of variation, maximum price, and average price equations) jointly using the seemingly unrelated regression or SUR technique. We found that there were no significant differences between SUR and OLS estimation equation by equation.

dispersion by 52%, from 0.313 to 0.150, in markets for toddler care. These findings are statistically significant and are consistent with the predicted effects of information provision. Moreover, they may be interpreted as evidence that parents of infants and toddlers who do value quality care highly are willing to bear greater search costs than parents who value child care quality less.

Predicted Coefficients of Variation
(Standard Errors in Parentheses)

Age Group	RANDR = 1	RANDR = 0	Sample Avg
Infants	0.081 (0.034)	0.317 (0.063)	0.152
Toddlers	0.150 (0.010)	0.313 (0.023)	0.194
Preschoolers	0.280 (0.043)	0.205 (0.093)	0.259
School-Age	0.331 (0.022)	0.452 (0.088)	0.345

There is some evidence that R&Rs reduce price dispersion for school-age care and no evidence that they affect dispersion of prices in the market for preschooler care. There are a number of potential explanation for the failure to find that a centralized source of information lowers the dispersion of prices for preschoolers and school-age care. Our model suggests either that parents who value high quality care are less willing to bear the transaction costs necessary to find high quality care for their older children. These parents may be willing to expend less effort to find care for their older than their younger children either because their older children are more able to fend for themselves or because they are typically in care for fewer hours. It may also be that parents of older children are well informed about child care options, because they are more likely to have dealt with child care issues in the past. Consequently, parents of older children may not benefit from the services of R&Rs as much as parents of younger children.

5.2 Maximum Price

We find that R&Rs significantly reduce maximum price for infant and toddler care. The table below summarizes predicted effects along with standard errors, for markets with and without R&Rs. The presence of R&Rs reduces maximum price by 35%, from $100.17 to $64.68 per week, in markets for infant care, and it reduces maximum price by 29%, from $106.41 to $75.047 per week, in markets for toddler care. These findings are consistent with predicted effects of information provision and provide even stronger evidence that parents who value quality care highly are willing to bear substantial search costs to find care for their youngest children.

Predicted Maximum Prices
(Standard Errors in Parentheses)

Age Group	RANDR = 1	RANDR = 0	Sample Avg
Infants	64.677 (3.582)	100.176 (7.794)	74.642
Toddlers	75.047 (2.853)	106.411 (6.863)	82.552
Preschoolers	38.526 (3.333)	45.344 (8.697)	40.182
School-Age	51.013 (4.157)	93.536 (15.486)	57.527

There is also evidence that R&Rs reduce maximum price for school-age care, by 45%, from $93.54 to $51.01. Finally, there is no statistical evidence that R&Rs affect the maximum price for preschooler care. This latter result provides further support for the contention that parents who value high quality care are less willing to search assiduously to find care for their older children.

5.3 Average Price

We find that R&Rs reduce average market price, however these findings are not statistically significant at conventional levels. These results can be interpreted as indicating that even for their youngest children, parents who value quality highly are not willing to bear sufficient search costs. Consequently, the prices of higher quality firms do not rise by enough to significantly offset the decline in prices at lower quality firms.

The table below summarizes predicted effects, using market-level results, along with standard errors. Point estimates suggest that R&Rs reduce the average price of infant care by 11%, of toddler care by 6%, of preschooler care by 5%, and of school-age care by 18%.

Predicted Average Prices
(Standard Errors in Parentheses)

Age Group	RANDR = 1	RANDR = 0	Sample Avg
Infants	59.708 (2.350)	66.967 (5.122)	61.387
Toddlers	61.879 (1.284)	65.652 (4.811)	62.352
Preschoolers	28.277 (1.375)	29.667 (2.362)	28.421
School-Age	32.521 (1.543)	39.661 (4.652)	33.512

We also estimate the effects of R&Rs on average price using center level data. As with the market-level specifications, the point estimates suggest that R&Rs reduce average market price, but the estimated effects are not statistically significant at conventional levels.

Our results provide clear support for the contention that information provision can lower price dispersion and maximum price. According to propositions 1 and 2 of Section 3, these results imply that the willingness to search of high valuation consumers is sufficiently higher than the willingness to search of low valuation consumers. Our results are less clear about the effects of search costs on average price. Our model suggests that even if search raises price dispersion and maximum price, it may not raise average price. In order for average price to increase, the willingness to search of higher valuation consumers must be much higher than the willingness to search of lower valuation consumers. (See proposition 3 in Section 3.)

5.4 Other Findings

There are a number of other significant findings that are robust across specifications. First, we find that markets in states that allow parents to reduce their tax liability for child-care expenses (TAXDED) have significantly higher price dispersion for infant and toddler care, significantly higher maximum prices for infant, toddler, and school-age care, and significantly higher average prices for toddler, preschooler, and school-age care. These findings suggest that firms capture some of the benefits of the state tax deduction.

We also find that markets with higher fractions of college educated people (COLLEGE) have significantly higher price dispersion for infants and toddlers, but significantly lower price dispersion for preschoolers and school-age children. There is also some evidence that COLLEGE raises the maximum price for infant care and raises the average price for toddler, preschooler, and school-age care. Interestingly, COLLEGE and median family income (LINCOME) have very different effects on price distributions. Controlling for COLLEGE, we find that LINCOME has virtually no effect on price dispersion or maximum price. If anything, there is some evidence to suggest that median family income has a negative effect on the average price of infant, toddler, and school-age care.

Higher rents are associated with significantly more price dispersion, higher maximum, and higher average prices for all age groups. Higher wages, however, have surprisingly little effect on price distributions. Work by Mukerjee and Witte (1993) and Mocan (1995) suggests that higher wages are associated with significantly higher costs for child care centers. These results led us to expect a positive effect of wages on maximum and average prices. If anything, we find some evidence that wages actually reduce maximum price for infant care. A potential explanation may lie in understanding the effect of higher wages on quality competition. If higher wages prohibitively raise the cost of high quality care, firms may choose not to differentiate as much in the quality spectrum (see Ronnen (1991)), which would in turn intensify price competition and reduce maximum and average price.

6. Quality Distributions

In this section, we empirically study the effects of information provision on the distribution of staff/child ratios. Staff/child ratios are a widely watched measure of observable quality and are considered to be an important determinant of good quality care.

A well-established result is that price competition erodes unobservable quality. No one has, as far as we are aware, explicitly modeled the effects of information on observable product quality. Ronnen (1991) studies the strategic behavior of firms that compete in both price and perfectly observable quality. He shows, in a model where consumers have full information, that firms differentiate themselves in the quality spectrum in order to soften subsequent price competition. Specifically, he shows that firms will increase quality differentiation, thus raising quality dispersion, in response to mechanisms that intensify price competition. Since better information may increase price competition, we might expect markets with better information (i.e, markets with R&Rs) to have higher quality all other things equal.

We summarize the distribution of staff/child ratios across markets with and without R&Rs, for each of the four age groups, in Table 3. These raw data suggest that markets with R&Rs have less dispersion, lower maximum, and lower average staff/child ratios. As with prices, the effects may be explained by differences in consumer demographics or input costs that are correlated with the presence of R&Rs. Recall that markets with R&Rs tend to have higher incomes, are more educated, have higher rents and are more urban than markets without R&Rs.

To control for other effects on the distribution of staff/child ratios, we estimate the reduced form models described in Section 4. Methodologically, we proceed in a manner analogous to the one adopted for the study of price distributions. For each dependent variable (coefficient of variation of staff/child ratios, maximum staff/child ratio and average staff/child ratio), we estimate separate models for infant, toddler, preschooler, and school-age groups, using ordinary least squares with market-level data. Standard errors are heteroskedasticity robust. We also estimate the effect of R&Rs on average staff/child ratios using center level data. For brevity, we summarize the main results from these fifteen regressions in Table 7, which includes the estimated coefficients with associated t-statistics on RANDR.

Our findings indicate that R&Rs have no significant effect on staff/child ratios. Moreover the point estimates are fairly small in absolute value, though they are, for the most part negative. This is an important finding since it suggests that the beneficial effects of R&Rs on price distributions are not offset by a significant deterioration in observable quality. We cannot, of course, say anything about effects on unobservable quality.

7. Summary and Conclusions

Markets where consumers have imperfect product information are pervasive. In many of these markets, because of potentially high externalities, governments, not-for-profit institutions and employers have intervened by providing information to better inform consumers. In the case of child care markets, voluntary bodies and employers have responded by providing consumers with information. Despite the prevalence of various non-advertising mechanisms for providing information, very little is known about their effectiveness.

This paper exploits a unique feature of child care markets and unique features of our data to study the effects of a non-advertising form of information provision on market outcomes. Some child care markets are served by resource and referral agencies (R&Rs) that provide consumers with information on availability, price and observable characteristics of care. To the extent that R&Rs reduce consumer search costs, price competition in markets with R&Rs should differ from that in markets without R&Rs. We employ results from a special survey conducted for this research, which allows us to determine empirically which areas had R&Rs in 1990, the year of our data. We exploit local variation in the availability of these agencies to study the effects of centralized information provision on the distributions of prices and of an observable measure of quality.

We develop a theoretical model that reflects important aspects of the child care market. The model assumes that firms in the market are vertically differentiated. Consumers to engage in costly search to obtain their preferred price and quality combination. We derive conditions under which provision of information reduces price dispersion, maximum price and average price. The theoretical work indicates that information provision will reduce price dispersion as long as consumers who value quality highly are willing to bear search costs that are at least comparable to the costs born by consumers who value quality less highly. Markets with lower search costs can only be expected to have lower prices if consumers who value quality highly are willing to bear substantially higher search costs than consumers with lower valuations of quality. Our empirical work is designed to explore the empirical relevance of these theoretical results for child care markets.

We empirically estimate the effects of R&Rs on price dispersion, maximum price, and average price for care. We separately study the effects of information provision on market for the care of infants, toddlers, preschoolers, and school-age children because of inherent differences in care technologies, regulations and information feedback across the different age groups. Older children require less attention from caretakers, and these children are better able to provide parents with more information about the type of care they receive than are younger children. Parents of older children may also be more familiar with local child care options because they have been using child care for more years than parents of younger children. Consequently, information provision may be less useful to parents of older children.

We find that R&Rs have economically large and statistically significant effects on market prices for the care of the youngest children. Results indicate that markets with R&Rs have significantly lower price dispersion and lower maximum prices than markets without R&Rs for the care of infants and toddlers. The results also suggest that R&Rs reduce average prices for infant and toddler care, though these effects are not statistically significant at conventional levels. We find that R&Rs have no effect on the distribution of prices for the care of preschoolers. Finally, we find that R&Rs do not significantly affect price dispersion and average price, but do reduce the maximum price for school-age care. Our model allows us to interpret these results in terms of the relative willingness of parents who value quality care highly and those who value quality care less to bear the costs of searching for the type of care they prefer for their children.

Decreases in prices and decreases in price dispersion may only be beneficial if they are not associated with lower quality. Because of obvious data limitations, we cannot study the effects of information provision or intensified price competition on unobservable product quality. We do, however, study the effects of R&Rs on the distribution of staff/child ratios, an observable measure of quality that is believed to be an important determinant of care quality. We find generally that markets with R&Rs have staff/child ratios that are insignificantly different from those in markets without R&Rs.

This paper extends the literature in a number of ways. First, it provides evidence on some potential effects of publicly supported information provision in markets with vertical differentiation. Currently policy proposals in the health and child care areas rely heavily on information provision to alleviate perceived market failures. It is believed that information provision in such market settings will help consumers locate service providers that best suit their needs. Our work indicates that information provision can have other beneficial effects as well.

It is most likely to lower the dispersion of prices. Information provision will lower price dispersion if information asymmetries are severe and consumers' willingness to search is positively correlated with consumers' valuations of quality. If consumers' willingness to search is sufficiently positively correlated with their valuations of quality, information provision may also reduce maximum and average prices. However, as we have shown in the case of child care markets, information may not significantly affect average prices or the average level of observable quality.

To structure our empirical work, we develop a theoretical model that allows us to discern the effects of information on the price distribution in a vertically differentiated market. We hope that this work will encourage theorists to consider further the implication of information provision in markets with complicated structures like the health and dependent care markets.

In terms of empirical methods, we use carefully defined local markets as well as individual firms as the unit of observation. The use of well-defined markets is important because the strongest prediction of theory relates to price dispersion. We can only observe the dispersion of prices at the market level. As far as we are aware, there is only one other study that considers the effect of information on price dispersion. This study finds that the dispersion of prices in states that allow advertising of prices for eye examination is lower than the dispersion of prices in states that prohibit such advertising (Feldman and Begun, 1980). Markets for eye examinations like markets for child care are likely to be local not statewide. It would be interesting to see if price dispersion in carefully defined local markets were also to be lower in states that allow advertising. Finally, our study is only the second to explicitly examine the effects of information on the distribution of observable product quality. For previous work, see Kwoka (1984).

We conclude that provision of information by R&Rs can significantly alter competition in child care markets. The findings suggest that centralized information provision may indeed be useful in alleviating some market imperfections arising from information imperfections. Most directly, information provision lowers consumer search costs. The theoretical model suggests that information provision may also increase market participation. Both our theoretical and empirical work indicate that R&Rs can reduce price dispersion without eroding staff/child ratios in markets with substantial information imperfections. Our work also cautions that enthusiasm for information provision as a means to solve market imperfections must be tempered. For example, our work indicates that information provision does not significantly lower average price or increase quality as measured by the staff-child ratio. Further, we are not able to study the effect of the increased price competition that can be engendered by information provision on unobservable quality.

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Table 1 (a)
Variable List and Descriptive Statistics
Unit of Observation = Center

Acronymn	Definition	N	Average	RANDR=1	RANDR=0
			Firm Characteristics		
ASCRATI	Actual staff/child ratio for infant groups.	331	0.295	0.297	0.290
ASCRATT	Actual staff/child ratio for toddler groups.	520	0.201	0.191	0.241
ASCRATPS	Actual staff/child ratio for preschool groups.	837	0.140	0.139	0.146
ASCRATS	Actual staff/child ratio for school-age groups.	532	0.143	0.136	0.164
FORPROFIT	Indicator: 1 if center is for profit.	945	0.582	0.572	0.612
NLCHAIN	Indicator: 1 if center is part of a national or local chain.	945	0.098	0.103	0.080
PRICEI	Weekly price for infant (5 days a week, 10 hours a day).	197	62.558	66.417	53.955
PRICET	Weekly price for toddlers (5 days a week, 11 hours a day).	348	64.591	66.963	57.218
PRICEPS	Weekly price for preschoolers (5 days a week, 3 hours a day).	285	30.047	31.528	26.046
PRICES	Weekly price for school children (5 days a week, 3 hours a day).	321	37.914	39.646	28.959
RANDR	Indicator: 1 if center in county/area with resource and referral agency.	945	0.801	1.000	0.000
RENT	Cost of living adjusted, median contract rent per room in '89	945	65.990	70.534	47.526
WAGES	Cost of living adjusted, median hourly wage of center teachers in '89	945	6.645	6.716	6.357
			Demographics		
COLLEGE	Fraction of the population that is college educated.	936	0.221	0.235	0.163
INCOME	Cost of living adjusted, median family income.	929	35644.138	36516.708	32115.890
LDENSITY	Population over square miles.	940	5.884	6.130	4.898
FINFANT	Fraction of children below age 13 who are infants.	931	0.065	0.066	0.061
FTODDLERS	Fraction of children below age 13 who are toddlers.	936	0.157	0.158	0.153
FPRESCH	Fraction of children below age 13 who are preschoolers.	936	0.218	0.220	0.210
FSCHOOL	Fraction of children below age 13 who are school-age.	936	0.560	0.556	0.577
MALEWK	Percent full-time male labor force participation	936	53.977	53.982	53.956
PBLACK	Percent of the population black.	898	0.151	0.135	0.216
PKIDS	Fraction of population below age 13.	936	0.196	0.194	0.203

Table 1 (b)

Variable List and Descriptive Statistics (PSU Level)*

Acronym	Description	N	Average
	Tax Code		
TAXDED	Indicator: 1 if state tax deduction for child care expenses	34	0.558
	Center Regulations		
INSPECT	Number of mandated inspections per year.	100	1.567
TRAIN	Indicator: 1 if pre or in-service training required	100	0.910
SQFEET	Minimum square feet of indoor space per child.	99	33.434
SCRATI	Minimum staff/child ratio for groups with infants.	100	0.201
SCRATT	Minimum staff/child ratio for groups with toddlers.	100	0.183
SCRATPS	Minimum staff/child ratio for groups with preschoolers.	100	0.092
SCRATS	Minimum staff/child ratios for groups with school-age.	100	0.058
GRSI**	Maximum group size for infants.	100	16.667
GRST	Maximum group size for toddlers.	100	18.182
GRSPS	Maximum group size for preschoolers.	100	40.000
GRSS	Maximum group size for school-age.	100	56.180
INSURE	Indicator: 1 if liability insurance required.	100	0.350
	Family Day Care Regulations		
FINSPECT	Number of mandated inspections per year.	100	0.751
FGRSZ	Maximum group size.	100	2.94
FTRAIN	Indicator: 1 if pre or in-service training is required.	100	0.152

* Primary sampling units consist of county or county groups, spanning 34 states. Most regulations are vary only by state, though some vary by county. Tax deductibility of child care expenses varies by state.

**Descriptive statistics are presented for maximum group size. Regression analysis controlls for inverse of the maximum group size: IGRSI, IGRST, IGRSPS, IGRSS, FIGRS. Inverse of the maximum group size varies from zero to one and regulations can be interpreted as becoming more stringent as IGRS increases.

Table 2

Summary Statistics for Prices
Unit of Observation: Market

Description	Base Radius = 3		
	Full Sample	RANDR = 1	RANDR = 0
Weekly Market Price for Infant Groups 5 days a week, 10 hours a day (N = 31)			
Average	61.387	61.921	60.080
Coefficient of Variation	0.152	0.148	0.162
Maximum	74.642	74.844	74.149
Number of Centers	4.419	4.818	3.444
Weekly Market Price for Toddler Groups 5 days a week, 11 hours a day (N = 59)			
Average	62.325	65.075	54.256
Coefficient of Variation	0.194	0.206	0.161
Maximum	82.552	88.356	65.525
Number of Centers	4.729	5.159	3.467
Weekly Market Prices for Preschooler Groups 5 days a week, 3 hours a day (N = 49)			
Average	28.421	30.700	22.725
Coefficient of Variation	0.259	0.293	0.173
Maximum	40.182	45.333	27.305
Number of Centers	4.327	4.743	3.286
Weekly Market Prices for School-Age Groups 5 days a week, 3 hours a day (N = 60)			
Average	33.512	35.020	25.974
Coefficient of Variation	0.345	0.340	0.372
Maximum	57.527	61.614	37.087
Number of Centers	25.974	0.372	37.087
All prices are cost of living adjusted, using a regional cost of living index from the American Chamber of Commerce.			

Table 3

Summary Statistics for Staff/Child Ratios
Unit of Observation: Market

Description	Base Radius = 3		
	Full Sample	RANDR = 1	RANDR = 0
Staff/Child Ratios for Groups with Infants (N = 62)			
Average	0.305	0.298	0.320
Coefficient of Variation	0.324	0.303	0.369
Maximum	0.471	0.455	0.508
Number of Centers	4.367	4.926	3.158
Staff/Child Ratios for Groups with Toddlers (N = 69)			
Average	0.195	0.186	0.229
Coefficient of Variation	0.359	0.355	0.373
Maximum	0.330	0.312	0.395
Number of Centers	5.241	5.692	3.611
Staff/Child Ratios for Groups with Preschoolers (N = 96)			
Average	0.143	0.140	0.154
Coefficient of Variation	0.355	0.348	0.378
Maximum	0.249	0.256	0.259
Number of Centers	5.835	6.394	3.857
Staff/Child Ratios for Groups with School-Age Children (N = 85)			
Average	0.144	0.133	0.172
Coefficient of Variation	0.412	0.400	0.444
Maximum	0.262	0.236	0.332
Number of Centers	4.604	5.029	3.462

Table 4
Effect of R and Rs on Coefficient of Variation in Price - Market-Level Regressions

Variable	Infants (1)	Toddlers (2)	Preschoolers (3)	School-Age (4)
RANDR	-0.236 (2.507)	-0.163 (6.036)	0.075 (0.606)	-0.121 (1.189)
LINCOME	0.036 (0.169)	0.005 (0.036)	0.222 (0.656)	0.546 (2.774)
COLLEGE	0.972 (2.423)	0.332 (2.032)	-1.371 (2.415)	-0.269 (2.401)
TAXDED	0.555 (2.636)	0.087 (3.003)	-0.175 (1.592)	-0.003 (0.063)
FORPROF	0.317 (1.753)	-0.243 (4.562)	0.328 (2.064)	-0.147 (1.967)
CHAIN	0.155 (0.946)	0.063 (1.424)	0.137 (1.187)	-0.032 (0.492)
WAGES	-0.053 (1.477)	0.015 (2.135)	-0.005 (0.320)	-0.038 (1.841)
RENT	0.017 (3.839)	0.003 (3.533)	0.005 (1.656)	0.010 (6.358)
R-Squared	0.540	0.719	0.141	0.467

Absolute value of T-statistics shown. All specifications include a constant, ln(INCOME), COLLEGE, MALEWK, TAXDED, ln(DENSITY), PBLACK, PKIDS, FORPROFIT, CHAIN, WAGES, RENT, INSPECT, TRAIN, SQFEET, INSURE, FINSPECT, FIGRSZ, and FTRAIN. Further, infant specifications include FINFANT, IGRSI, and SCRATI. Similarly, toddler, preschooler, and school-age specifications include corresponding fraction of children below age thirteen, inverse of maximum group size, and minimum staff/child ratio.

Table 5
Effect of R and Rs on Maximum Price - Market-Level Regressions

Variable	Infants (1)	Toddlers (2)	Preschoolers (3)	School-Age (4)
RANDR	-35.499	-31.364	-6.819	-42.523
	(3.248)	(3.836)	(0.620)	(2.464)
LINCOME	-20.667	31.532	10.563	-13.069
	(0.984)	(0.966)	(0.305)	(0.314)
COLLEGE	75.972	56.497	-20.737	76.007
	(1.952)	(1.452)	(0.515)	(1.257)
TAXDED	60.188	33.594	9.771	33.353
	(3.480)	(4.306)	(1.279)	(2.948)
FORPROF	31.895	-22.146	10.574	-7.237
	(1.317)	(1.285)	(0.831)	(0.481)
CHAIN	17.622	3.915	-0.404	-10.326
	(1.126)	(0.439)	(0.046)	(0.758)
WAGES	-6.421	-1.878	-1.888	1.361
	(1.923)	(1.002)	(1.317)	(0.342)
RENT	2.620	1.799	1.032	3.601
	(5.169)	(6.841)	(3.889)	(5.883)
R-Squared	0.599	0.761	0.234	0.756

Absolute value of T-statistics shown. All specifications include a constant, ln(INCOME), COLLEGE, MALEWK, TAXDED, ln(DENSITY), PBLACK, PKIDS, FORPROFIT, CHAIN, WAGES, RENT, INSPECT, TRAIN, SQFEET, INSURE, FINSPECT, FIGRSZ, and FTRAIN. Further, infant specifications include FINFANT, IGRSI, and SCRATI. Similarly, toddler, preschooler, and school-age specifications include corresponding fraction of children below age thirteen, inverse of maximum group size, and minimum staff/child ratio.

Table 6
Effect of R and Rs on Average Price: Market and Center Level Regressions

Variable	Infants		Toddlers		Preschoolers		School-Age	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
RANDR	-4.865 (1.198)	-7.260 (1.021)	-7.083 (1.464)	-3.777 (0.677)	-2.756 (0.723)	-1.390 (0.422)	-8.720 (1.213)	-7.139 (1.345)
LINCOME	3.615 (0.398)	-27.008 (1.865)	-35.785 (2.790)	6.210 (0.511)	-8.610 (1.039)	4.366 (0.271)	-27.457 (1.664)	-8.682 (0.479)
COLLEGE	0.457 (0.030)	-6.041 (0.214)	75.396 (3.833)	10.833 (0.568)	26.874 (1.877)	2.906 (0.151)	112.808 (4.276)	49.053 (1.980)
TAXDED	2.585 (0.710)	-0.003 (0.000)	-0.498 (0.132)	8.988 (2.482)	7.108 (2.511)	7.009 (2.060)	5.153 (1.038)	13.647 (3.016)
FORPROF	8.641 (2.431)	-1.534 (0.103)	7.956 (1.716)	7.996 (1.191)	-1.853 (0.559)	2.009 (0.329)	1.628 (0.254)	2.651 (0.364)
CHAIN	-0.768 (0.273)	-0.488 (0.043)	2.232 (0.661)	3.422 (0.794)	0.934 (0.384)	0.987 (0.263)	1.524 (0.351)	9.387 (1.401)
WAGES	-0.014 (0.016)	-0.294 (0.203)	-1.059 (1.041)	-0.744 (0.721)	1.196 (1.647)	-0.036 (0.066)	1.243 (0.939)	-0.077 (0.064)
RENT	0.452 (3.988)	0.564 (1.840)	0.520 (4.815)	0.561 (5.630)	0.204 (2.143)	0.387 (3.945)	0.511 (3.275)	0.830 (4.357)
R-Squared	0.596	0.594	0.385	0.583	0.186	0.363	0.418	0.634

Absolute value of T-statistics shown. For each age group, first column is estimated using center level data, and the second column is estimated using market-level data. All specifications include a constant, ln(INCOME), COLLEGE, MALEWK, TAXDED, ln(DENSITY), PBLACK, PKIDS, FORPROFIT, CHAIN, WAGES, RENT, INSPECT, TRAIN, SQFEET, INSURE, FINSPECT, FIGRSZ, and FTRAIN. Further, infant specifications include FINFANT, IGRSI, and SCRATI. Similarly, toddler, preschooler, and school-age specifications include corresponding fraction of children below age thirteen, inverse of maximum group size, and minimum staff/child ratio.

Table 7
Effect of R and Rs on the Distribution of Staff/Child Ratios

Dependent Variable	Infants (1)	Toddlers (2)	Preschoolers (3)	School-Age (4)
Coefficient of Variation in Staff/Child Ratio	-0.064 (0.435)	0.060 (0.388)	-0.004 (0.053)	-0.001 (0.010)
Maximum Staff/Child Ratio	-0.044 (0.248)	-0.061 (0.374)	0.031 (0.494)	-0.009 (0.114)
Average Staff/Child Ratio, Market-Level	-0.015 (0.295)	-0.021 (0.706)	-0.005 (0.211)	0.015 (0.690)
Average Staff/Child Ratio, Center Level	-0.007 (0.171)	-0.019 (0.787)	0.007 (0.555)	0.004 (0.172)

Absolute value of T-statistics shown. The estimate in each cell was retreived from an individual regression. For example, effect of R&Rs on the coefficient of variation in infant staff/child ratioe was retrieved from a regression of actual coefficient of variation in infant staff/child ratio on a constant, RANDR, ln(INCOME), COLLEGE, MALEWK, TAXDED, ln(DENSITY), PBLACK, PKIDS, FORPROFIT, CHAIN, WAGES, RENT, INSPECT, TRAIN, SQFEET, INSURE, FINSPECT, FIGRSZ, FTRAIN, FINFANT, IGRSI, and SCRATI. The Table reports only the coefficient on RANDR, in cell 1 of row 1. Similar regresions were run to retreive estimates for each of the other cells.