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AN EMPIRICAL INVESTIGATION OF FIRMS' RESPONSES TO MINIMUM STANDARDS REGULATIONS

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ABSTRACT

We study firms' responses to minimum standards and other forms of regulatory intervention on both the probability of exit and the distribution of observable product quality, using firm level data for a nationally representative sample of markets. Our empirical work is motivated by the literature on quality and price competition in the presence of minimum standards. We find that minimum standards increase the probability that firms exit certain markets. Moreover, we find that exit can cause both the average and the maximum quality observed in the market to decline. This perverse regulatory effect occurs when excessively high standards cause high quality firms to exit. When minimum standards do not lead to exit, minimum standards can increase the average and maximum quality of products in the market. Such standards can not only force low quality firms to raise their quality, but may cause high quality firms to increase quality, presumably in an attempt to alleviate price competition and differentiate themselves from their now higher quality rivals.

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Minimum product quality requirements are common in a variety of settings. For example, car makers must meet fuel-economy standards, builders are required to meet fire safety requirements, and a wide variety of producers face product safety regulations imposed by the federal and many state and local governments. Human service providers are subject to a wide array of both product specific and firm level standards. Despite this widespread use of minimum standards, there is only limited empirical evidence on their impact.

In this paper, we study the effect of minimum standards on the behavior of child care centers. Providers of child care are subject to varying degrees of quality regulation as are most other human service organizations. Most state and local governments enforce minimum quality standards, such as minimum staff-child ratios and maximum group size limits, to assure acceptable levels of costly child care quality.[1] Most of these standards affect observable aspects of product quality. They are intended to force firms to produce and consumers to consume higher levels of costly quality, for the usual externality or paternalistic reasons.[2]

The theoretical literature on minimum standards generally considers single product firms that compete in both price and product quality. The literature can be divided into two strands. One strand considers markets in which quality is unobservable to consumers while the other considers markets with observable quality.[3] Both strands generally conclude that excessively stringent standards will cause firms to exit. With price competition and observable quality, Crampes and Hollander (1995) show that high quality firms will exit the market first in response to excessively stringent standards, if variable costs are quality-dependent. In this setting, standards may result in lower average market quality. Ronnen (1991) also shows that binding minimum standards will affect price and quality competition between firms and distort the distribution of market qualities. He finds that appropriately chosen minimum standards can (1) raise average market quality, (2) raise quality supplied by all firms, not just by firms for whom standards are binding, and (3) reduce variance in qualities if quality dependent costs are sufficiently large.

The empirical literature, discussed in Section 2, has primarily focussed on the effect of regulatory stringency on the number of products or the number of producers in the market. As far as we are aware, there is no empirical evidence on the effect of such regulations on the distribution of market qualities.

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[1] See National Research Council, *Who Cares for America's Children*, (Washington, D.C.: National Academy Press, 1990), for a discussion of regulatory goals.

[2] H.K. Gruenspecht and L.B. Lave (1990), "Economics of Health, Safety, and Environmental Regulation," *Handbook of Industrial Organization*, point out that paternalism, not market failure, is the primary motivation behind many health, safety, and environmental regulations.

[3] Studies in which quality is unobservable include Akerlof (1970), Leland (1979), and Shapiro (1983). Studies in which quality is observable include Ronnen (1991) and Crampes and Hollander (1995).

We are primarily interested in two issues: (1) the effect of *product-specific* regulations and (2) the effect of *firm-level* regulations on product offerings and on the distribution of product quality. This work is designed to add to the existing literature on the effect of quality regulation on firms' willingness to supply. It also designed to empirically examine theoretical predictions regarding the effects of minimum standards on the distribution of market quality.

We employ firm level data from a nationally representative, random sample of child care centers spanning 100 US counties/county groups and 34 states. Centers in the same geographic market compete both in price and costly quality, and consumers have heterogeneous willingness and ability to pay for high quality care. Minimum standards regulations govern observable aspects of care quality and are enforced through the use of state and locally mandated inspections. Our data contain detailed information on regulatory intensity, which varies both across states and localities and across child age groups. Firms choose the ages of children they will care for (their product mix) and the quality of care to provide. We consider three distinct age groups: young (below age three), preschool (between ages three and six), and school age. In equilibrium, care providers are vertically differentiated, and markets support a distribution of qualities for each child age group. Sections 3 and 4 of the paper describe the structure of the market and the data in more detail.

In Section 5, we consider the effects of product-specific regulations. Specifically, controlling for demographic, center characteristics and market characteristics, we estimate the impact of age-specific staff/child requirement and age-specific group size limitations on the willingness of firms to provide care for children of different ages and on the quality of care available in the market for each age group. By sample construction, all centers in our sample provide care for preschoolers. Of these centers, 71% care for young children and 65% care for school age children. Consequently, we separately estimate the reduced form effect of regulatory stringency on the center's propensity to serve young and school age children. We find that higher staff-child requirements for young children result in significantly lower probabilities that firms will provide care for young children and that lower group size requirements for school age children lower the probability that firms will provide school age care. These results are consistent with previous empirical studies (e.g. Wiggins (1981), Carroll and Gaston (1991), and Gormley (1991) that show that regulatory stringency reduces equilibrium supply. In the case of young children, the decreased willingness of high quality firms to supply care results in a decline in the average and maximum staff/child ratios available to the parents of young children. This is, as far as we are aware, the first empirical evidence of the perverse regulatory effect predicted by Crampes and Hollander (1995).

In Section 6, we examine the effect of firm-level minimum standards regulations, which include per-child minimum space requirements and staff training requirements. We find that such regulations have unanticipated consequences. In a number of settings, they deteriorate other aspects of product quality. For example, staff training requirements decrease both the average and maximum staff-child ratios available in the market, suggesting that centers hire fewer staff when staffs are required to be trained. In Sections 7 and 8, we examine the effect of mandated inspections and insurance requirements. Interestingly, we find that liability insurance requirements are more consistently associated with improved quality than either product-specific or firm-level minimum standards requirements. In Section 9, we discuss the pervasive "regulatory spillover" effects that we observe. The final section contains our conclusions.

2. Empirical Literature

The empirical literature has focused primarily on the effects of regulatory stringency on market supply. Wiggins (1981) studies the effects of product quality regulations on new drug introductions. He finds that regulatory stringency reduces the rate of introductions and research spending. Carroll and Gaston (1991) examine the effects of licensing restrictions on the provision of professional services and find that licensing restrictions significantly reduce the stock of licensees. Gormley (1991) studies the effects of minimum quality standards on the number of child care centers in a state. He finds that higher mandated staff-child ratios, required liability insurance, and high square footage requirements all reduce the number of child care centers. All of these studies conclude that regulatory intensity reduces market supply.

As far as we are aware, there is no empirical evidence on the effect of quality regulations on the distribution of market qualities. A handful of studies have examined the effect of regulations on average effective quality. For example, Carroll and Gaston (1991) argue that as the stock of licensed professionals decreases, market prices will increase and consumers will turn to non-market or unlicensed service providers. They find that accident rates, as measured by number of unintended electrocutions, are higher in states that have more stringent licensing requirements on electricians.

Only a few studies have examined the role of regulations in the market for child care. Gormley (1991), discussed above, uses state-level data on the number of licensed child care centers. Chipty and Witte (1994, 1995) use individual, demand-side data to examine the effect of minimum quality regulations of parents' child care choices. They find that mandated inspections, group-size regulations, minimum staff/child ratios and training requirements have significant effects on the prices families pay for care, the hours of care they purchase for their children and the actual staff/child ratio of the care they choose. As far as we are aware,

there is no previous work that uses firm-level data to study the effect of minimum quality standards in the child care or any other market.

3. The Market for Child Care

Unique features of the child care markets allow us to examine both firm-level and market-level predictions of the effects of minimum quality standards. In this paper, we focus on child care centers, the largest providers of non-parental care.[4] Centers compete in price and costly quality. They are also subject to a diverse set of minimum quality regulations. These include minimum staff-child ratios, group size limits, liability insurance requirements, staff training requirements, and square footage requirements. Most of these standards govern aspects of care that can be directly, and often better, observed by consumers or parents than by regulators.

Since 1982, states have had the primary responsibility for regulating child care, and regulations have generally become more stringent over time.[5] Regulations may differentially affect firms' choice of product offerings and distort choice of inputs, conditional on offering a product.[6] To study these effects, we employ variation in regulatory intensity across geographic areas and across child age categories. States vary dramatically in their specific provisions. Moreover, local areas in some states have regulations that exceed state levels. Some regulations, such as minimum staff-child ratios and maximum group size limits, are age or product specific. These minimum standards are most stringent for young groups and least stringent for school age groups.[7] Such restrictions will differentially distort firm choice of product offerings.

We also exploit variations in input requirements across child age categories to identify effects of regulations. When products vary in input requirements, even firm-level regulations, such as staff training and square footage requirements, may distort centers' choice of product offerings. For example, staff

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[4] There are primarily two types of non-parental child 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, though in various specifications, we control for the effects of family regulations on outcomes in the markets for center care.

[5] For discussions see Hayes, et al. (1990), Morgan (1986), Morgan (1989) and Morgan (1993).

[6] Regulations may also affect firms' decisions to enter and exit the market. However, due to data limitations, we cannot determine the extent of this effect. By studying propensity to serve certain age groups, though, we are able to shed light on the overall incentive to enter or exit the market.

[7] For example, the median mandated staff/child ratio for young children is 1/5 while the median staff/child ratio for school age children is 1/18.

training requirements which generally require either formal degrees or training in child development will differentially impact the labor intensive product, the care of young children. Square footage per child requirements may make the space-intensive product, caring for older children, relatively more attractive.

Regulations may also affect the nature of competition between centers in the market. Markets for child care are very localized, for parents overwhelmingly prefer to have their children cared for in their own residential neighborhood (Committee for Children, 1996). Centers within markets compete in both price and quality. The measures of quality on which we focus are actual staff-child ratios and actual group sizes, widely watched indicators of the adequacy of child care services.[8] Quality differentiation softens price competition and most markets offer a distribution of quality, with many firms well above regulated minimum levels and some firms below the regulated minimum.[9]

To enforce regulations, states and local areas mandate that centers be inspected. The frequency of these mandated inspections varies considerably. Inspections have limited direct cost to firms because they are conducted and paid for by state and local governments. However, when firms are in noncompliance, inspections may cause firms to make costly changes in their operations. Inspections may be more than simply the instrument by which regulations are enforced. They may provide parents with information that is costly or impossible for parents to obtain directly. If inspections are informative, they will affect consumer demand either because they increase consumer confidence in the quality of care or because they decrease parental monitoring costs.

4. Data

To study the effect of minimum standards and inspections, we combine data from: (1) the 1990 Profile of Child Care Settings (PCS),[10] (2) the 1990 Census, (3) various compilations of state regulations, and (4) local regulations. The PCS contains detailed firm-level information for stratified random samples of child care centers in 100 county/county groups chosen to be representative of the US.[11] Eighty nine percent or

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[8] 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.

[9] Clearly, there is some noncompliance with these minimum standards, as with many other regulations. However, we find here, as do Chipty and Witte (1995) and Chipty (1995) *op. cit.*, that regulations have economically large and statistically significant affects on market outcomes.

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

[11] The centers in the PCS should be representative of all centers operating in the market. In contrast to family

2039, of the over 2300 centers chosen, were interviewed using computer aided telephone interviewing. For this study, we exclude Head Start centers and centers sponsored by public schools. Such centers are highly subsidized and may be less responsive to market forces.[12] 945 market-oriented centers remain and we focus on these centers. For each center, the data include information on location, ages of children served, and other center-level data. The data also contain information, such as group size and staff-child ratio, at the group level for each group at each center. Such group or classroom-level data is rarely available for analysis.

The PCS data offer a number of advantages for studying the effects of minimum standards. First, they provide detailed firm-level data so that we can examine firm choices. We consider firms' decisions regarding the age of children for which they provide care. The sampling design for the PCS insures that all firms in the PCS serve preschool children. The firms in the PCS differ only in whether or not they provide care for young children (YOUNG), defined to be less than three year old, and school-age children (SCHOOL), defined as children who are six or older. We study firms' decisions whether or not to provide care for young and school age children. Seventy-one percent of the centers in our sample provide care for young children and sixty-five percent care for school age children. Other center-level variables we are able to control for include whether the center is for profit (FORPROFIT) and whether the center is part of a national or local chain (NLCHAIN).

The data also contains information on the groups in which children actually receive care. Centers generally have at least three distinct groups and groups generally contain only children of specific ages. For each center, we identify groups that care for young children and groups that care for school age children. We then construct average group size and average staff child ratios for young groups (AGRSZY and ASCRATY) and average group size and average staff child ratios for school age groups (AGRSZS and ASCRATS).

In addition, the data provide detailed geographic information that allows us to define local child care markets. We partition our centers into geographic markets based on proximity, in miles, 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 certain base

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day care home, centers rarely are able to operate in the underground economy. This is true because centers are large commonly caring for more than 100 children.

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

radius of at least one other center in the market.[13] We experimented with various market definitions from three miles to twenty miles. We also considered counties as possibly defining markets. We report results with base radii of three, five, and eight miles, which provide a sensible partition of our data. Table 2 summarizes market definitions with a variety of base radii. A base radius of three divides our sample of centers into 225 geographic markets, with an average number of 4 firms that are on average 2 miles apart. A base radius of five divides our sample into 136 geographic markets, with an average of 7 firms that are on average 5 miles apart. Point estimates vary depending on the definition of the market, but the flavor of the results is invariant to a variety of market definitions.

For each center, we obtain demographic information at the five-digit zip code level from the 1990 Census. In this paper, we employ data on median family income (INCOME), fraction of children less than 13 who are less than 3 years old (FYOUNG), fraction of children less than 13 who are school age (FSCHOOL), and population density (DENSITY) - measured as population per square mile. Data on family income are deflated by a regional cost of living index at the county level (American Chamber of Commerce, 1990).

Finally, we collected information on state and local minimum standards for each of the 34 states included in the PCS sample. This information was collected from published sources, Morgan (1986) and Morgan (1993), and directly from local regulatory documents for centers and family day care homes. For each area, we document the following center regulations: (1) whether liability insurance is required (INSURE), (2) whether pre or in-servicing training is required for the staff (TRAIN), (3) the required minimum square feet of indoor space per child (SQFEET) (4) maximum group size (GRSZ) by age, and (5) the minimum staff-child ratio (SCRAT) by age. We also document regulations imposed on family day care homes, for these providers are likely to compete with centers and regulatory spillover effects have been found in previous work (Chipty and Witte, 1994, 1995). For family day care homes, we collected information on maximum group size (FGRSZ) allowed, and whether pre or in-service training is required (FTRAIN). Finally, we collect information on the number of inspections required per year for centers (INSPECT) and family day care homes (FINSPECT). We use mandated rather than actual inspections

[13] To define markets, we begin with a center and identify all centers within a base radius of the starting center. All of these centers are assigned to the same geographic market. We then take each center in this market and identify all centers within the base and assign them to the same market. We repeat this procedure until we can identify no other centers close to any center in the market. Close is defined in terms of miles, and miles are determined as the crow files and do not account for the curvature of the earth.

because they can more reasonably be considered exogenous to firm behavior. All regulations are transformed such that an increase in the variable can be interpreted as increased regulatory stringency.[14]

Descriptive statistics are presented in Table 1. Table 1(a) contains a summary of the center and demographic characteristics. Table 1 (b) contains a summary of the regulatory and inspection variables.

5. Product-Specific Regulation

As noted previously, the theoretical literature shows that excessively stringent standards can cause firms to exit the market. This literature provides ambiguous predictions regarding the effect of regulations on average product quality. If only variable costs rise with product quality, as in Crampes and Hollander (1995), then excessively stringent standards will case high quality firms to exit first. In this case, both the average quality and the best quality available in the market may decline. Alternatively, if only fixed costs are quality dependent, as in Ronnen (1991), then minimum standards may raise average quality even if they result in some exit.

Appropriately chosen standards will not cause firms to exit the market. Rather, they will force low quality firms to provide higher quality care. As these low quality firms move to higher levels of quality, higher quality firms are forced either to compete more intensely in price or to dampen price competition by moving to higher levels of quality. The theoretical literature shows that these firm level responses can lead not only to higher average product quality, but also to higher quality for firms for which standards do not bind. Ronnen (1991) shows that if costs of quality improvements rise sufficiently fast, appropriately chosen standards will ultimately reduce the variability of quality in the market.

5.A Effects on Exit/Entry

To discern the effect of minimum standards on firms willingness to supply products, we estimate the impact of age-specific standards regarding minimum staff/child ratios and maximum group sizes on the probability that firms will offer care for young and care school age children. Excessively stringent regulation for one age group may cause firms either to cut back or simply to stop serving children in the age category. Firms may switch to caring for children in other age categories or they may simply reduce the number of

[14] For example, instead of group size limits (GRSZ), we control for 1/GRSZ (referred to as IGRSZ), where IGRSZ goes from zero (least stringent or no regulation) to one (most stringent).

children for whom they care. To obtain our results, we specify and estimate the parameters of reduced form profit equations. Profits are a function of firm characteristics (FIRM), consumer characteristics

$$\pi^{*}_{pims} = \beta_p 0 + FIRM_{ims}\beta_p 1 + CONSUMER_{ms}\beta_p 2 + REGS_s\beta_p 3 + \alpha_{pm} + \varepsilon_{pims}$$

(CONSUMER), and regulations (REGS):

where i indexes the center, m indexes the market, s indexes the state or locality, and p indexes the product (care for the young and care for the school age). Unobservables α_{pm} and ε_{pims} are the market-specific effect and the true randomness, respectively. FIRM includes whether the center is part of a national or local chain and whether the center is for-profit. CONSUMER includes median family income, fraction of children under 13 that are young, fraction of children under 13 that are school age, and population density. Since we are considering the firm's decision as to whether or not to offer product p, we obtain Probit estimates for the parameters of (1).

We account for unobservable market specific heterogeneity, α_m , for each product p using random-effect Probit estimation, under the standard assumption of equicorrelated errors ($\mathrm{Var}(\alpha_m) = \sigma^2$ for all m). The likelihood function is the product of the probability of observing the given sequence of outcomes across the markets, where $\tilde{}_m = \alpha_m/\sigma$ be the standardized random effect. For each product, the probability of

$$Prob_m(\alpha_m) = \prod_{t=1}^{T_m} \Phi(\, Z_{tms}\,\beta + \sigma_{\_m}\,)^{y_{tms}}\,(\,1 - \Phi(Z_{tms}\,\beta + \sigma_{\_m}\,)\,)^{1\,-\,y_{tms}}$$

observing the sequence of outcomes in any particular market m is given by

where T_m is the number of centers in market m; Z_{tms} is the vector of explanatory variables which includes firm characteristics, consumer characteristics, and regulations; and $\beta = (\beta_0, \beta_1, \beta_2)$. The unobservable component, $\tilde{}_m$ is integrated out using Hermite integration of order 8 (Butler and Moffit, 1982, Abramowitz and Stegun 1972).

Column (1) of Tables 3 and 4 contains standard Probit estimates. Columns (2)-(4) of Tables 3 and 4 contain random effects Probit estimates of equation (1), for markets with base radii of three, five, and eight miles. The estimated correlation of errors across centers in the same market is statistically significant in most cases. This provides evidence that there are unobserved market specific effects. Measures of fit range from 0.15 to 0.38, depending on market definition, for the young children specification and they range from 0.11

to 0.33, depending on market definition, for the school age specification. Allowing for errors to be correlated across centers in the same market significantly improves the goodness of fit.

The estimates indicate that certain age-specific minimum standards significantly reduce firms' willingness to supply care. To be more specific, we find that centers in areas with higher staff-child requirements for young children are significantly less likely to provide care for young children. We find no significant effect of school-age staff/child requirements on firms' willingness to supply school age care. Centers in areas that require lower maximum sizes for groups of school age children are less likely to provide care for school age children. This effect is significant for two of our three market definitions. We find no significant effect of group size regulations on firms' willingness to provide care for young children.

5.B Effects on Product Quality

To discern the effects of minimum standards on firms' choices of regulated, observable quality, we estimate the impact of age-specific minimum staff/child ratios and maximum group size restrictions on the mean, maximum and variance of actual staff/child ratios and group sizes observed in markets. Both the staff/child ratios and group sizes are directly regulated, and both are considered important measures of child care quality.[15]

$$f(\,Y_{kpm}\,) \;=\; \beta_{kpf}0 \;+\; FIRM_{kpm}\;\beta_{kpf}1 \;+\; CONSUMER_{kpm}\;\beta_{kpf}2$$

$$+\; REGS_{kpm}\;\beta_{kpf}3 \;+\; u_{kpmf}$$

We estimate market-level equations of the following form

where k indexes a dimension of quality (either ASCRAT or AIGRSZ), m indexes the market, p indexes the product (care for the young and care for the school age), and $f(Y_{kpm})$ = average, maximum, or variance in actual quality measure k for centers in market m that offer product p. Geographic markets are defined, as described in Section 3, using distance in miles, for base distance radii of three, five, and eight miles.

Parameters are estimated using ordinary least squares. Results are presented in Tables 6 and 7, for staff-child ratios and group sizes, respectively. Standard errors are heteroskedasticity robust. In Table 6, R-squareds range from 0.141 to 0.758, and in Table 7, they range from 0.141 to 0.758.

Recall that the effect of regulations on average quality depends upon whether regulations are excessively stringent, causing some firms to cease to offer products. When regulations do not cause firms to exit, the

[15] See Helburn *et. al.* (1995), Clarke-Stewart (1987), and Roupp, Travers, Glantz, and Coelen (1979).

theoretical literature predicts that more stringent binding regulations will cause the average quality observed in the market to increase. When regulations cause firms to exit, the quality enhancing direct effect of regulations may be offset by the exit of high quality firms from the market. If the quality diluting exit effects dominates, more stringent standards may actually lower both the average and maximum quality observed in the market. The variance of quality observed in the market may decline as well.

Effects with Exit

When regulations cause firms to exit, we find that the quality-diluting effect of exit can dominates any direct quality-enhancing effects of more stringent standards. To be more specific, we find that more stringent staff/child requirements, which cause firms to exit the market for young children, are associated with decreases in both the average and the maximum staff/child ratios observed in the market. We also find that markets with more stringent standards have less disperse staff/child ratios. We obtain these results for all market definitions. However, the effects are only statistically significant at normal levels when a radius of three miles defines the market.

Recall that regulations that require smaller group sizes for school age children cause firms to exit the school age market. Exit in this market is either not strong enough or not concentrated enough in the high quality firms to cause quality to deteriorate. However they are strong enough to swamp any beneficial direct effects of group size regulations for school age care.

Our results provide empirical support for the potential quality diluting effect of very stringent regulation. This effect is caused by the exit of high quality firms and was first formalized by Crampes and Hollander (1995).

Effects without Exit

As predicted by the theoretical literature, we find that in the absence of exit, binding regulations raise the quality of products in the market. To be more specific, we find that higher required staff/child ratios for school age children are associated with significantly higher average and maximum staff/child ratios. We also find that, if anything, the variance of staff/child ratios for school age children is higher in areas with more stringent regulations. This would result if more stringent regulations led high quality firms to competitively increase quality. This increase in quality would stretch the upper tail of the quality distribution. If the increase in the upper tail was sufficiently large to offset any shrinkage in the lower tail caused by regulatorily imposed quality improvements among low quality firms. As noted by Ronnen (1991), this would occur if quality-dependent costs were not too large.

We find no significant effects of direct group size regulations for school age children. However, our results indicate that group size regulations for young children lead to smaller average and maximum group sizes in the market. Again, we find, as predicted by the theoretical literature, that when regulations do not cause exit, they can lead to improved product quality.

6. Firm-Level Regulations

Firm-level standards are commonly imposed on multi-product firms. For example, occupational safety and health regulation are imposed at the firm not the product level. In spite of the importance of firm-level regulation and of multi-product firms, the theoretical literature, as far as we are aware, has not formally modeled the impact of this type of regulation.

In single-product firms, binding input restriction will increase firm use of the regulated input and, with positive elasticities of substitution and no demand side effects, decrease the utilization of substitutable inputs. Firms may also alter the quality of the products they produce. Multi-product firms have an additional margin of adjustment. They may alter their product mix as a result of such regulations. To explore the effects of firm-level input requirements, we consider the effect of two regulations - minimum square foot per child requirements and staff training requirements.

To understand the potential effect of firm-level input restrictions on product mix, it is necessary to describe input requirements for the products we are considering, care of young children and care of school age children. Child care centers must provide for the physical needs and safety of children and may provide child development and educational activities as well. In terms of physical needs, young children are the most labor-intensive product and school age children the least labor intensive. School age children require more space on average than do young children. The variance of child development/educational activity generally increases with the age of the child.

6.A Effects on Exit/Entry

As can be seen in Tables 3 and 4, firm-level input restrictions only significantly affect the probability that firms will care for school age children. To be more specific, higher space requirements increase the probability that firms will offer care for school age children, the space-intensive product. Staff's training requirements have no significant effect on the probability that firms will care for young or school age children.

6.B Effects on Product Quality

Firm-level square footage requirements significantly decrease average staff/child ratios for school age children and decrease the maximum staff/child ratio observed for both young and school age children. They also increase the maximum group size observed for young and school age children. These results are consistent with simple substitution effects. Faced with higher space requirements, firms substitute space for labor. They also care for children in larger groups.

The results for school age care also reflect the entry into school age care engendered by the square footage requirements. The firms entering the school-age market as a result of higher square footage requirements appear to have lower staff/child ratios than firms currently in the market. The variance of staff/child ratio observed in the market for both young and school age children is lower in areas with higher space requirements.

Training requirement decrease the average and maximum staff/child ratio for school age children but have no significant effects on the staff/child ratio for younger children. Again this may reflect the entry of lower quality firms into the school age market as a result of the firm-level input restrictions.

7. Liability Insurance Requirement

Insurance requirements are pervasive (e.g., liability insurance, medical insurance) and generally imposed at the firm rather than the product level. Insurance requirements may have diverse effects. Their direct effect is to raise product costs. Because liability insurance premiums are experience-based, liability insurance requirements may also change safety related product quality attributes and the product mix offered by the firm. Firms may chose to cut back production of accident-prone products. Finally, insurance requirements may increase consumer confidence and, thus have demand side effects. Our results allow us to examine the effect of liability insurance requirements on product mix and product quality.

We find that liability insurance requirements have no significant effect on product mix. However, they have strong and significant effects on product quality. To be more specific, liability insurance requirements are associated with significantly higher average staff/child ratios and lower group sizes for both young and school age children. They are also associated with a greater variance in staff/child ratios.

8. Mandated Inspections

Regulations of observable quality are generally enforced by inspections that are designed to discern if required minimum standards are being met. To round out our work, we consider the effect of mandated

inspections on product mix and product quality. Inspections may alter producer behavior. Bureaucratic monitoring may also increase consumer confidence and supplement or substitute for consumer monitoring.

We find that increases in mandated inspections are associated with a significant 11% increase in the probability that firms will provide care for young children and a marginally significant 7% increases in the probability that firms will provide care for school age children. We find that inspections have no significant effect on product quality for either young or school age children.

Our results are consistent with the effects of mandated inspections being primarily on consumers. We find no significant effect on producer behavior. Since inspections have no significant effect on quality, consumer effects would have to result from "consumer illusion" or from mandated inspections serving as a substitute for consumer monitoring of producers.

9. Regulatory Spillover

The theoretical literature on the effect of regulations suggests that there will be extensive regulatory "spillover." That is, regulations of one economic sector will affect not only that sector, but also sectors that compete with or supply the sector. Further, product-specific regulations imposed on multi-product firms may affect not only the product regulated, but also other products produced by the firm. As far as we are aware there is limited empirical evidence on the nature and significance of such regulatory spillover effects.

Chipty and Witte (1995) find that there was significant regulatory spillovers in the child care industry. To be more specific, they find that regulation of child care centers had significant effects on family child care homes and that regulations of child care homes significantly affected center behavior. In the work reported here, we incorporate family child care regulations and again find that these regulations have significant effects on the behavior of child care centers.

Our work also indicates that regulations for one product can significantly affect firms' behavior regarding other products. That is, we find intra-firm regulatory spillover. As can be seen in Table 4, we find that both staff/child ratios and group size limitations for young children significantly affect the willingness of firms to provide care for school age children. As can be seen in Table 6, we also find that areas that require smaller groups for school age children have lower average group sizes for infants. Binding group size requirement may cause firms to reconfigure interior space. Such reconfiguration could well be the source of regulatory spillover for group size limitations. As can be seen in Table 5, staff/child requirements do not appear to have any significant intra-firm spillover effects on quality.

10. Conclusions

Our work shows that minimum standard regulations can have significant effects both on product offerings and the quality of products available in the market. Some results support proponents of regulations who believe that regulations have beneficial effects. For example, we provide evidence that product-specific regulations can improve the average quality of products available in the market. This beneficial effect of regulation only occurs if regulations do not cause firms to cease supplying the regulated product. When regulations are sufficiently stringent to cause firms not to supply the regulated product, we find that product-specific minimum standards can actually lead to a deterioration of the quality of products available in the market.

We also provide evidence that firm-level input requirements can have detrimental effects on important dimensions of product quality. To be more specific, we find that both firm level per child space requirement and firm level staff-training requirement lead to a deterioration of staff/child ratios and group sizes available in the market. These detrimental effects occur both because of firm input substitution and changes in firms' product mix. We also provide evidence regarding the effect of liability insurance requirements imposed at the firm level. We find that such requirements, in our setting, have no statistically significant effect on product mix. We suspect that this finding may not be widely generalizable. Both the medical malpractice and product liability literatures suggest that firms do move away from products with high accident rates when subject to more stringent liability rules. We also find that liability requirements have more consistently beneficial effects on the quality of products in the market than any other regulations we examined. This was quite surprising to us. We believe that this is a finding that merits more investigation.

Our final set of findings relates to regulatory spillover. We provide strong empirical support for the types of regulatory spillover found in the theoretical literature. We find that imposing regulations on an industry affects not only that industry, but also industries that compete with firms in the regulated industry. We also provide evidence that product specific regulations can spill over from one product to another and have unexpected consequences.

We hope that our work will stimulate additional work on the effects of complex regulatory environments on multi-product firms. Our work indicates that the effects of regulations in such environments can be surprising. The effects can also have significant economic and social impact.

The Advisory Commission on Consumer Protection and Quality in the Health Care Industry is currently considering complex new regulatory requirements for health care providers. Our work suggests

some factors that such regulatory commission may want to consider when making their regulatory decision. Factors include the effect of regulations on firms' willingness to supply the regulated product, the effect of regulations on the quality and variety of products available in the market, the nature of the interactions among regulatory requirements and regulatory spillovers. Regulatory commissions may also want to consider the degree to which insurance requirements and the provision of consumer information can substitute for direct regulation.

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Table 1 (a)

Variable List and Descriptive Statistics

Unit of Observation = Center

Acronym	Definition	N	Average
Firm Characteristics			
YOUNG	Indicator: 1 if center serves kids < 3 years old	945	0.712
PRESCHOOL	Indicator: 1 if center serves kids 3 to 5 years old.	945	1.000
SCHOOL	Indicator: 1 if center serves kids > 5 years old.	945	0.649
ASCRATY	Actual Staff/Child Ratio for young groups.	649	0.234
ASCRATS	Actual Staff/Child Ratio for school age groups.	518	0.148
AIGRSZY	Actual 1/Group Size for young groups.	652	0.121
AIGRSZS	Actual 1/Group Size for school age groups.	521	0.095
GROUPS	Number of groups at center.	945	4.403
FORPROFIT	Indicator: 1 if center is for profit.	945	0.582
NLCHAIN	Indicator: 1 if center is part of a national or local chain.	945	0.098
RANDR	Indicator: 1 if center in area (or psu) with resource and referral agency.	945	0.801
Demographics			
INCOME	Cost of living adjusted, median family income.	929	35644.138
DENSITY	Population over square miles.	940	2071.809
FYOUNG	Fraction of children below age 13 who are young.	924	0.222
FSCHOOL	Fraction of children below age 13 who are school age.	929	0.560

Table 1 (b)
Variable List and Descriptive Statistics (State Level)*

Acronym	Description	N	Average
Center Regulations			
INSPECT	Number of mandated inspections per year.	34	1.560
TRAIN	Indicator: 1 if pre or in-service training required	34	0.912
SQFEET	Minimum square feet of indoor space per child.	32	33.280
INSURE	Indicator: 1 if liability insurance required.	33	0.364
IGRSZ1	Inverse of maximum group size for young children.	34	0.077
IGRSZ2	Inverse of maximum group size for preschoolers.	34	0.028
IGRSZ3	Inverse of maximum group size for school age children.	34	0.020
SCRAT1	Staff-Child ratio for young children.	34	0.217
SCRAT2	Staff-Child ratio for preschoolers.	34	0.091
SCRAT3	Staff-Child ratio for school age children.	34	0.057
Family Day Care Regulations			
FINSPECT	Number of mandated inspections per year.	26	1.156
FIGRSZ	Inverse of maximum group size.	32	0.154
FTRAIN	Indicator: 1 if pre or in-service training is required.	34	0.412

* Regulations are Known at the State and Local Level. For ease of exposition, average state-level regulations are shown in this Table.

Table 2
Market Definitions

Base Radius for Market Definition	# of Markets	Average across Markets	
		# firms in Market	Distance between Firms
3	225	4	2
5	136	7	5
8	75	13	12
10	57	16	18
15	38	25	32

Table 3

Entry-Exit Decision: Whether Firms Serve Young Children

Variable	Probit	Random Effects Probit		
		R = 3	R = 5	R = 8
CONSTANT	0.551 (0.719)	0.729 (0.882)	0.671 (0.829)	0.627 (0.777)
RHO		0.288 (1.558)	0.231 (1.416)	0.266 (2.301)
INSPECT	0.244 (3.887)	0.231 (3.208)	0.231 (3.267)	0.241 (3.401)
TRAIN	0.010 (0.043)	-0.030 (0.123)	-0.014 (0.058)	-0.031 (0.128)
SQFEET	-2.045 (1.127)	-2.226 (1.164)	-2.112 (1.118)	-1.629 (0.858)
INSURE	-0.116 (1.015)	-0.111 (0.898)	-0.112 (0.903)	-0.125 (0.973)
IGRSZ1	0.031 (0.027)	0.608 (0.430)	0.394 (0.294)	0.618 (0.450)
SCRAT1	-3.380 (2.425)	-3.600 (2.366)	-3.459 (2.322)	-3.659 (2.404)
IGRSZ3	-6.645 (1.652)	-8.094 (1.757)	-7.625 (1.719)	-7.905 (1.765)
SCRAT3	-5.654 (1.502)	-5.615 (1.379)	-5.583 (1.397)	-6.296 (1.553)
FORPROFIT	0.427 (4.363)	0.433 (4.314)	0.437 (4.374)	0.442 (4.408)
NLCHAIN	0.979 (3.866)	0.998 (3.850)	0.979 (3.831)	0.986 (3.865)
INCOME	0.061 (0.368)	0.043 (0.253)	0.040 (0.238)	0.025 (0.148)
FYOUNG	5.378 (3.368)	5.344 (3.226)	5.247 (3.210)	5.235 (3.194)
$1 - \ln L/\ln L_0$	0.152	0.382	0.290	0.227
Scaling Factor	0.310	0.543	0.546	0.537

Absolute value of T-statistic in parentheses below.

Table 4

Entry-Exit Decision: Whether Firms Serve School Age Children

Variable	Probit	Random Effects Probit		
		R = 3	R = 5	R = 8
CONSTANT	-0.477 (0.651)	-0.009 (0.010)	-0.306 (0.360)	-0.559 (0.641)
RHO		0.485 (4.066)	0.458 (3.611)	0.479 (3.714)
INSPECT	0.162 (2.968)	0.114 (1.535)	0.107 (1.448)	0.144 (1. 921
TRAIN	-0.135 (0.608)	-0.218 (0.836)	-0.223 (0.847)	-0.167 (0.673)
SQFEET	4.913 (3.396)	4.616 (2.491)	4.876 (2.593)	5.475 (3.024)
INSURE	0.062 (0.560)	0.041 (0.316)	-0.017 (0.120)	-0.072 (0.471)
IGRSZ1	3.103 (2.667)	4.610 (3.024)	4.476 (3.076)	4.949 (3.227)
SCRAT1	-6.042 (4.640)	-5.938 (3.745)	-5.196 (3.152)	-4.323 (2.643)
IGRSZ3	-6.639 (1.717)	-10.070 (2.058)	- 9.097 (1.920)	-10.260 (2.094)
SCRAT3	-0.382 (0.103)	-1.587 (0.355)	-0.936 (0.214)	-3.751 (0.832)
FORPROFIT	0.393 (4.224)	0.412 (4.186)	0.427 (4.357)	0.417 (4.279)
NLCHAIN	1.005 (4.723)	0.991 (4.441)	0.984 (4.479)	0.989 (4.521)
INCOME	-0.266 (1.700)	-0.335 (1.973)	-0.348 (2.069)	-0.382 (2.274)
FSCHOOL	0.698 (0.681)	0.534 (0.479)	0.619 (0.570)	0.635 (0.584)
$1 - \ln L/\ln L_0$	0.107	0.325	0.240	0.183
Scaling Factor	0.361	0.604	0.606	0.590

Absolute value of T-statistic in parentheses below.

Table 5

Effect of Minimum Staff-Child Ratios on the Distribution of Group Level Staff-Child Ratios

Variable	Centers that Serve the Young Children 441 Centers			Centers that Serve School Age Children 396 Centers		
	Base Radius = 5 Miles					
	Avg	Max	Var	Avg	Max	Var
Inspect	-0.022 (0.747)	-0.055 (0.772)	-0.008 (1.263)	0.040 (1.451)	0.081 (1.569)	0.001 (0.109)
Train	-0.037 (0.572)	0.017 (0.155)	-0.001 (0.048)	-0.185 (2.294)	-0.223 (2.034)	-0.008 (0.326)
Sqfeet	-0.005 (1.277)	-0.040 (3.897)	-0.002 (2.609)	-0.019 (2.750)	-0.048 (4.195)	-0.005 (1.574)
Insure	0.110 (3.489)	0.369 (3.731)	0.019 (2.466)	0.214 (4.252)	0.613 (3.964)	0.094 (1.844)
Igrsz1	0.385 (1.409)	0.666 (1.095)	0.032 (0.838)	-0.182 (0.789)	0.533 (0.857)	0.174 (1.201)
Igrsz3	1.068 (1.495)	0.585 (0.378)	0.053 (0.408)	1.644 (1.813)	1.154 (0.534)	0.369 (0.842)
Scrat1	-0.643 (1.361)	-1.445 (1.457)	-0.133 (1.455)	0.445 (0.694)	0.393 (0.478)	0.036 (0.196)
Scrat3	1.901 (1.417)	3.186 (1.250)	0.116 (0.576)	7.786 (3.765)	14.061 (2.695)	2.305 (1.464)
R-squared	0.177	0.340	0.209	0.609	0.477	0.0.379
Alternate Specification: Markets Defined with Base Radius = 3						
Scrat1	-0.781 (2.005)	-1.714 (2.311)	-0.160 (2.019)	-0.177 (0.371)	-0.594 (0.841)	-0.050 (0.457)
Scrat3	1.968 (1.701)	5.216 (2.274)	0.652 (0.652)	6.738 (3.458)	12.069 (2.520)	1.775 (1.259)
R-squared	0.185	0.294	0.156	0.451	0.364	0.262
Alternate Specification: Markets Defined with Base Radius = 8						
Scrat1	-0.951 (1.612)	-2.758 (1.245)	-0.335 (1.552)	0.525 (1.046)	2.621 (1.428)	0.684 (1.740)
Scrat3	-7.419 (3.725)	-5.264 (0.724)	-0.960 (1.055)	10.073 (5.694)	32.034 (4.304)	5.942 (2.566)
R-squared	0.568	0.539	0.410	0.707	0.636	0.634

Absolute Value of T-Statistic in parentheses. All specifications include: INCOME, DENSITY, FYOUNG, FSCHOOL FORPROFIT, NLCHAIN, RANDR, FINSPECTS, FTRAIN, FIGRSZ, IGRSZ1, IGRSZ2, IGRSZ3, SCRAT1, SCRAT2, and SCRAT3.

Table 6

Effect of 1/Maximum Group Size Restrictions on Distribution of 1/Group Size

Variable	Centers that Serve Young Children (444)			Centers that Serve School Children (366)		
	Base Radius = 5 Miles					
	Avg	Max	Var	Avg	Max	Var
Inspect	-0.001 (0.099)	-0.043 (1.032)	-0.002 (0.778)	-0.007 (0.234)	0.013 (0.261)	0.001 (0.308)
Train	-0.005 (0.196)	0.040 (0.639)	0.001 (0.202)	-0.100 (1.697)	-0.176 (2.057)	-0.010 (1.214)
Sqfeet	-0.001 (0.874)	-0.014 (3.538)	-0.000 (1.273)	-0.009 (1.823)	-0.018 (2.223)	-0.001 (1.150)
Insure	0.030 (2.249)	0.095 (2.673)	0.002 (1.129)	0.101 (3.222)	0.240 (3.042)	0.020 (1.671)
Igrsz1	0.297 (3.019)	0.728 (2.493)	0.020 (1.547)	0.242 (1.255)	0.991 (2.324)	0.103 (2.343)
Igrsz3	0.701 (2.248)	-0.518 (0.605)	-0.015 (0.306)	1.352 (1.535)	0.343 (0.229)	-0.004 (0.033)
Scrat1	-0.313 (1.593)	-1.013 (1.986)	-0.057 (1.762)	0.092 (0.222)	0.107 (0.145)	-0.005 (0.076)
Scrat3	0.417 (0.910)	-0.411 (0.303)	-0.063 (0.706)	4.885 (2.422)	7.645 (2.253)	0.578 (1.434)
R-squared	0.378	0.349	0.141	0.417	0.368	0.390
Alternate Specification: Markets Defined with Base Radius = 3						
Igrsz1	0.311 (3.120)	0.801 (3.253)	0.023 (2.350)	0.050 (0.161)	0.256 (0.691)	0.017 (0.793)
Scrat1	-0.324 (1.564)	-1.055 (2.801)	-0.052 (2.405)	-0.348 (0.758)	-0.516 (0.956)	-0.006 (0.213)
Igrsz3	0.776 (2.233)	-0.285 (0.385)	-0.025 (0.769)	1.024 (1.073)	0.604 (0.470)	0.014 (0.149)
Scrat3	0.645 (1.006)	0.789 (0.776)	-0.025 (0.865)	3.583 (1.918)	5.558 (1.858)	0.415 (1.188)
R-squared	0.302	0.309	0.135	0.240	0.223	0.239
Alternate Specification: Markets Defined with Base Radius = 8						
Igrsz1	0.102 (0.930)	0.614 (1.590)	-0.004 (0.230)	-0.011 (0.065)	2.621 (1.428)	0.684 (1.740)
Scrat1	-0.488 (2.296)	-2.054 (2.081)	-0.123 (2.636)	0.608 (1.839)	1.389 (1.475)	0.137 (1.293)
Igrsz3	1.130 (4.071)	2.415 (2.065)	0.098 (1.698)	1.245 (1.841)	32.034 (4.304)	5.942 (2.566)
Scrat3	-2.254 (2.781)	-5.217 (1.338)	-0.423 (2.149)	11.231 (6.664)	21.655 (6.148)	1.597 (2.747)
R-squared	0.712	0.605	0.455	0.758	0.636	0.634

Absolute Value of T-Statistic in parentheses. All specifications include: INCOME, DENSITY, FYOUNG, FSCHOOL FORPROFIT, NLCHAIN, RANDR, FINSPECTS, FTRAIN, FIGRSZ, IGRSZ1, IGRSZ2, IGRSZ3, SCRAT1, SCRAT2, and SCRAT3.