The Impact of Minium Quality Standards on Firm Entry, Exit and Product Quality: The Case of Child Care Market

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Abstract

We examine the impact of minimum quality standards on the supply side of the child care market, using a unique panel data set merged from the Census of Services Industries, state regulation data, and administrative accreditation records from the National Association of Education for Young Children. We control for state-specific and time-specific fixed effects in order to mitigate the biases associated with policy endogeneity. We find that the effects of quality standards specifying the labor intensiveness of child care services are strikingly different from those specifying staff qualifications. Higher staff-child ratio requirements deter entry and reduce the number of operating child care establishments. This entry barrier appears to select establishments with better quality into the market and alleviates competition among existing establishments: existing establishments are more likely to receive accreditation and higher profits, and are less likely to exit. By contrast, higher staff-education requirements do not have entry-deterrence effects. They do have the unintended effects of discouraging accreditation, reducing owners' profits, and driving firms out of businesses.

JEL codes: L5 (Regulation and Industry Policy), L8 (Industry Studies: Services)

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1. Introduction

Minimum quality standards have been used extensively to regulate the products and services of a number of different sectors of the economy. For example, the government subjects automobile manufacturers to fuel-economy standards, and older cars to smog checks to ensure that they meet certain emission standards. Health care professionals, and apropos of this study, child care providers, must pass detailed licensing requirements in order to practice their occupations.

There are several rationales typically offered for the regulation of the quality of products or services. One rationale arises for markets in which informational asymmetries exist between sellers and consumers. Consumers may have less information about product quality than sellers do and sellers may not have sufficient incentives to voluntarily disclose such information (Akerlof, 1970). Such informational asymmetries can lead to adverse selection problems in the provision of quality by sellers. These informational problems are exacerbated if the use of low-quality products can cause irreparable harm to consumers (e.g., child abuse by unfit child care providers). Even in the absence of informational imperfections, the failure of consumers to take account of the negative externalities associated with the consumption of low-quality products also may motivate product quality regulation. For example, emission standards on automobiles is usually motivated by the argument that consumers did not adequately account for the externalities associated with the pollutants that older model automobiles emit into the atmosphere. Similarly, parents may not take account of the full social benefits that exposing their pre-school children to developmentally-enriching child care has on the learning of other children when their ill-prepared child enters the first grade.[1]

Regardless of the motivation, the imposition of minimum quality standards is one regulatory response in markets where high-quality products or services are under-produced and under-consumed. The goal of such regulatory interventions is to increase the production and consumption of higher quality

[1] For example, see Lazear (2001), who considers a model of the production of education in classrooms which explicitly takes account of the consequences of misbehaving students on the educational attainment of the other students in the class.

products and, ultimately, improve social welfare.[2] At issue, is whether such standards achieve these objectives. A number of theoretical studies have examined the consequences of minimum quality standards under different assumptions about the structure of markets. Work by Leland (1979) and Shapiro (1986), for example, focuses on the effects of such standards in the presence of the informational asymmetries between consumers and sellers but otherwise assume that markets are competitive. They find that while imposing minimum quality standards can improve social welfare under certain assumptions about consumer preferences, such improvements need not occur and can reduce the well-being of some (or all) consumers by restricting the range of quality from which consumers can choose and/or by increasing the equilibrium price of regulated goods and services. Ronnen (1991) and Crampes and Hollander (1995) stress that the consequences of minimum quality standards for the distribution of quality available ton consumers may depend on the degree of competition in markets, as imposing such standards can induce quality (and possibly price) competition among sellers in markets that are less than perfectly competitive markets.

In this study, we empirically investigate the impact of minimum quality standards on the supply side of a particular market, namely the market for child care services. We focus on the entry, exit, and aggregate supply of child care establishments in geographical markets within the U.S. Moreover, we examine the effects of such standards on a direct measure of the quality of child care services. We conduct our analyses with a unique panel data set obtained by merging child care sector data from the Census of Services Industries (1987, 1992, and 1997) with state regulation data and information on the accreditation of child care centers from the National Association of Education for Young Children (NAEYC)[3] in the corresponding years. The resulting data set contains detailed information on establishments such as their legal form of organization, tax-exempt status, revenue, payroll, employment and accreditation status, as well as state-level minimum quality standards they faced with respect to various aspects of child care ser-

[2] Note that the imposition of minimum quality standards is not the only potential regulatory response to the above problems. For example, informational asymmetries might be addressed in certain circumstances by requiring sellers to disclose the quality of their products.

[3] NAEYC is an independent not-for-profit organization that provides accreditation services to child care centers. Data from this source will allow us to construct a measure of service quality for the childcare establishments in the Census of Services Industries.

vices.

In our empirical analysis, we pay particular attention to the identification of the causal effects of minimum quality standards on the choices made by child care providers. Most previous empirical investigations rely on the variation in regulations across states for identification. While there is substantial variation in these regulations across states,[4] state child care regulations may be correlated with other state-level policies, conditions in related markets (e.g., in labor markets) or characteristics and preferences of consumers which also may have direct effects on the behavior of child care establishments. Failure to adequately control for these confounding factors in estimation will tend to produce biased estimates of the causal effects of minimum quality standards. We attempt to mitigate the intrusion of such bias by controlling for a rich set of market-level variables and, more importantly, by including state-specific and time-specific fixed effects in the empirical models we estimate. The latter is possible, given the panel structure of our data on child care establishments.

Ours is not the first study that attempts to estimate the causal effects of minimum quality standards on the behavior of firms in the child care industry. Previous investigations include work by Gormley (1991), Lowenberg and Tinnin (1992), Chipty (1995), Chipty and Witte (1997) and Blau (2004). Of these, the papers by Chipty and Witte (1997) and Blau (2004) are closest to ours. Both Chipty and Witte (1997) and Blau (2004) analyze cross-sectional data on specialized samples of child care establishments to examine the effects of state child care regulations on the input utilization, prices charged, wages paid and alternative measures of the quality of child care services. Given our access to data on the *census* of all child care establishments which hire at least one child care worker, we produce estimates of the effects of minimum quality standards for the U.S. as a whole. Moreover, the fact that we have panel data on these establishments allows us to examine the entry and exit of firms in response to changes in the child care standards states impose on such firms.[5] Without true panel data, the analyses in Chipty and Witte (1997)

[4] See Blau and Currie (2004) and Currie and Hotz (2004) for evidence on the extent of differences in specific child care regulations across states in the U.S.

[5] We note that most of the empirical work on the entry and exit of firms from markets has been limited to the manufacturing sector. See, for example, Dunne, Roberts, and Samuelson (1988, 1989a, 1989b) and Greenstone (2002).

and Blau (2004) resort to more indirect strategies for identifying the effects of such standards on the entry and exit decisions of child care establishments.

We find that minimum quality standards that regulate the labor intensiveness of child care services have strikingly different effects from those that regulate staff qualifications. We find that higher staff-child ratio requirements deter entry and reduce the number of operating child care establishments. This entry barrier appears to select establishments with better quality in to markets and alleviates competition among existing establishments. Existing establishments are more likely to receive accreditation and higher profits, and are less likely to exit. In contrast, higher staff-education requirements do not appear to have any entry-deterring effects. However, we also find that more stringent education requirements have the seemingly unintended effects of discouraging accreditation, reducing owners' profits, and driving firms out of businesses. We show that minimum quality standards governing different dimensions of quality, even within a specific industry, have very conflicting effects on seller behavior. Our findings, especially those on the impact of staff-qualification requirements, go beyond the predictions of existing theory and suggest that one needs to model the input as well as product markets in order to understand the effects of such regulations have on firm behavior and the distribution of quality available to consumers.

The paper proceeds as follows. Section 2 reviews both theoretical and empirical literature on minimum quality standards. Section 3 and 4 introduces the child care market, state regulations, the NAEYC accreditation system, and the data we use. Section 5 describes our empirical methodology. Section 6 presents our findings. Section 7 concludes.

2. Previous Studies on the Effects of Minimum Quality Standards

A number of theoretical and empirical studies have examined the consequences of minimum quality standards under different assumptions about the structure of markets for differentiated products. Assuming that minimum quality standards are binding and fully enforced, the theoretical literature seems

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For a literature review on firm turnover in the manufacturing industries, see Caves (1998).

to agree on their negative effects on entry and aggregate supply of regulated products, while diverging about the effects on the distribution of product quality. Data availability limited the empirical literature on the supply side, mostly confining researchers to using cross-sectional variation to identify the effects of regulations on aggregate supply, leaving other significant issues unexplored.

Leland (1979), Shapiro (1986), and Walker (1991) focus on the effects of minimum quality standards in the presence of informational asymmetries between consumers and sellers. Assuming a competitive environment, they argue that imposing minimum quality standards deters entry into markets for regulated products and causes low-quality sellers to exit the market. They also argue that minimum quality standards drive up prices and quality, assuming that regulated inputs affect quality and quality-dependent costs. The direct effect of minimum quality standards is to eliminate all products below a certain quality threshold. Sellers below the quality threshold may improve to just satisfy the standards, creating a spike to the right of the cut-off line. However, these predictions concerning the distribution of quality available to consumers are sensitive to the nature of competition in markets. Under imperfectly competitive markets, sellers may find it in their interest to strategically change the quality of their products in response to the imposition of minimum quality standards, even though these standards are not binding on the pre-regulation quality of their products. For example, high-quality sellers may want to produce even higher quality in order to avoid competition from their regulated low-quality rivals. This strategic response will shift the whole distribution of quality to the right, as illustrated by Figure 1 and shown by Ronnen (1991). He argues that properly chosen minimum quality standards raise the quality of products provided by all firms, not just by the firms for whom standards are binding. Furthermore, considering firms' quality-adjusting efforts as a response to minimum quality standards complicates analysis of the effects of these standards on firm exit. Firms with improved quality might be less likely to go out of business.[6]

The potential for strategic behavior in the presence of imperfectly competitive markets also applies to the effects of minimum quality standards on prices. On the one hand, market price levels may rise

[6] Crampes and Hollander (1995) show that when the variable cost function is convex with respect to quality and there is no quality-dependant sunk cost, the imposition of minimum quality standards creates incentives for firms to leave, but it is the high-quality, rather than the low-quality, firms that exit first.

if the imposition of standards drives up quality-related production costs for sellers. On the other hand, prices may fall if minimum quality standards distort the quality distribution of regulated products and intensify price competition among sellers, as shown by Ronnen (1991). Additionally, prices may fall if consumers purchase more stringently regulated products because these regulations assure consumers of what quality they receive. That is, minimum quality standards that are more stringent credibly eliminate "lemons" from the market. In this case, minimum quality standards that are more stringent stimulate the demand side of market (Hotz and Kilburn, 2000). These conflicting effects of minimum quality standards on prices, quality, and cost structure make it unclear whether surviving firms will benefit from regulations that are more stringent.

Most of the empirical work on the effects of minimum quality standards has focused on the demand side, largely due to the greater availability of data on consumer behavior relative to that on the behavior of sellers.[7] On the supply side, most studies evaluate the effects of minimum quality standards on reducing aggregate supply, leaving the effects on prices and quality largely uninvestigated. For example, Wiggins (1981) finds in a study of new drug introductions that more stringent regulations reduce the rate of introductions and research spending. Carroll and Gaston (1981) find that licensing restrictions significantly reduce the stock of licensees in the professional services market. Several empirical studies focus on the child care market. Both Gormley (1991) and Lowenberg and Tinnin (1992) find that more stringent minimum quality standards reduce the number of child care slots available per child in licensed programs. Blau (2003) studies the supply side from the perspective of the probability of a woman being employed as a child care worker. He finds that the econometric methods used significantly affect the estimated effects of minimum quality standards. For example, Blau finds that a summary index of regulatory stringency has

[7] Hotz and Kilburn (1997, 2000) study whether the "quality assurance" effect of minimum quality standards will lead parents to participate more in the child care market, controlling for the shifting-out of parents' participation due to increased prices. They find that staff qualification requirements raise the likelihood of parents choosing daycare centers. However, the relationship between staff-child ratios requirements and choosing centers is not consistent with a quality assurance story: the higher the staff-child ratio requirement, the lower the probability that parents choose centers. Currie and Hotz (2003) support this "quality assurance" view by showing that regulations that are more stringent on child care providers reduce the incidence of unintentional child injuries. For a review of minimum quality standards on the demand side of the child care market, see Blau (2003).

positive effects on child care supply when state and time fixed effects are excluded, but has either zero or negative impacts when such fixed effects are included.

The two empirical studies most relevant to ours, Chipty and Witte (1997) and Blau (2004), have a wider focus on seller behavior but rather limited samples of firms. Chipty and Witte (1997) use a cross-sectional sample of approximately 1,000 child care centers from the 1990 National Child Care Survey. They find that more stringent minimum quality standards decrease the probability that firms providing for certain market segments, particularly for infant care. They also find that when minimum quality standards do not lead to lower levels of service provision, they tend to increase the average and maximum quality of services. They suggest that this is due to firm's attempts to alleviate price competition and differentiate themselves from their regulated rivals. Blau (2004) uses a detailed cross-sectional sample of child care centers surveyed in four states. With only cross-sectional variation in regulation from a limited number of states, he creatively exploits variation within states across age groups of children and job titles of staff.[8] He finds that minimum quality standards have some impacts on input use, but the positive effects on price or quality are not robust when he includes state fixed effects. In particular, he finds that tougher regulations result in lower wages for child care workers, suggesting works bear the incidence of the regulation.

As these studies suggest, the empirical evidence about the impact of minimum quality standards is far from adequate. The estimates produced with cross-sectional data in most of the previous work are subject to bias to the extent that unobserved sources of heterogeneity, such as unmeasured state characteristics, are correlated with the stringency of minimum quality standards. To our knowledge, our study is the first to investigate sellers' entry, exit and quality behavior in response to the imposition of minimum quality standards based on panel data for a complete census of firms rather than a geographically isolated sample. The data allows us to consider a wider class of estimators than have been used in previous work and provide estimates for the U.S. as a whole.

Our research on minimum quality standards is closely related to the literature on the effects of oc-

[8] However, Blau must assume that the regulatory effects on firm behavior are the same across age-specific services and types of workers in order to exploit the idea. It is not obvious that such restrictions hold.

cupational licensing.[9] This line of research finds that occupational licensing restricts individual workers' labor supply, creates wage premiums for licensed workers, but has little effects on quality of licensed product or service.[10] However, the major hurdle in this area remains data availability. Minimum quality standards, or in other words, licensing requirements on firms, differ slightly from licensing requirements on individual workers. For firms, entry, exit, and competition are issues that are more significant. The imposition of minimum quality standards also may have contradictory impacts on employers and employees. Still, the imposition of occupational licensing on workers can create entry barriers by requiring a minimum degree of competency on the part of suppliers of products or services.

3. The Child Care Market and Child Care Quality

The child care market has grown substantially in the last two decades, fueled largely by the rise of female labor force participation.[11] Based on the same data as used in this study, we note that the number of center-based child care programs[12] rose by 26% between 1987 and 1992 and by 21% from 1992 to 1997 (O'Neill and O'Connell, 2001). Primarily small businesses, child care centers compete in localized markets, as parents overwhelmingly prefer to have their children cared for in their own residential neighborhood (Hofferth et al., 1991).

[9] For example, the license requirements for the dentists, lawyers, barbers, and cosmetologists.

[10] Kleiner and Kudrle (2000) find few effects of tougher dental licensing requirements on malpractice insurance rates or complaints to state license boards. Angrist and Guryan (2003) find that state-mandated teacher testing increases teacher wages with no corresponding increase in quality. See Kleiner (2000) for a review on occupational licensing.

[11] According to the Bureau of Labor Statistics, in 1970 28.7% of mothers with children under age six worked; by 1990 this number had grown to 58.2%, and by 2000 64.4%. Correspondingly, non-parental child care has become an increasingly common choice. In 1995, according to the National Center for Education Statistics, more than 12.9 million of the 21 million children under six were in non-parental child care, and more than 6 million of these children were in center-based child care. Nationwide, about half of all working families with children under age 13 paid for child care in 1997. They paid an average monthly expense of $286 for these services, about 9% of their earnings (Giannarelli and Barsimantov, 2000).

[12] Childcare establishments take two primary forms — center-based programs and home-based programs. Center-based programs care for relatively large numbers of children in institutional settings while home-based programs care only for three to four children in home settings. Centers usually group children according to age while home-based programs mix children of all ages in an informal atmosphere. They are very different entities and subject to different sets of state licensing requirements.

On the surface, it would appear that consumers of child care services (i.e., parents) may face the sorts of informational asymmetries that can result in market failures. Evidence suggests that parents may not know or may have difficulty evaluating the qualifications of staff in a child care center, even when they incur substantial search costs to learn about providers (Mocan, 2001). Parents may not be able to spend a significant amount of time at the center to observe various dimensions of operation. In addition, the potential for child abuse or neglect in child care settings and its potentially damaging consequences are an important concern of parents with respect to their decisions concerning the non-parental care of their young children.

Many child development researchers and professionals argue that the availability of high quality child care remains a significant problem in the U.S. Studies by Whitebook, Howes, and Philips (1989) and the Cost, Quality and Outcomes Team (1995) have documented that only about 15% of all child care programs provide high-quality care that supports a child's health and social and cognitive development. Researchers in these studies found that barely adequate quality in the child care provided in a majority of programs they analyzed. Most establishments meet children's basic health and safety needs, but provide only a little warmth from adults, and few learning experiences. Poor quality is particularly prevalent in centers serving infants and toddlers.

4. The Data: Regulations, Establishments, Accreditation and Market Characteristics

4.1 State Child Care Regulations

The dramatic expansion of the child care market in the U.S. and the concerns of consumers (parents) and child developmental specialists about the quality of child care services has generated increased attention on the case for government intervention in this market. Government intervention has taken two firms: the provision of subsidies for child care, primarily associated with state and federal welfare programs and through the federal income tax system, and in the form of state mandated child care licensing requirements, i.e., minimum quality standards. Currently, every state regulates some dimension of child

care provision.[13] As is the case in the regulation of most services, states do not directly regulate the quality of care; rather, they regulate the *inputs* in the provision of care. In particular, most states impose requirements on the labor intensiveness of child care services (e.g., maximum child-to-staff ratios and group sizes by age group) and staff qualifications (e.g., minimum educational requirements and requiring criminal background checks for child care workers).[14] We focus our investigation on the effects of state regulations of the labor intensity and staff qualifications. Previous studies have found that the labor intensity of care and the educational qualifications of child care providers are associated with objective measures of child care quality, such as the cognitive, emotional and social development of young children.[15]

Table 1 provides summary statistics for the minimum staff-to-child ratios that apply to day care centers and educational requirements (years of schooling) for different types of child care workers for the years 1987, 1992, and 1997, the years for which we have data on child care establishments. Both the staff-child ratio and education requirements vary considerable across states.[16] Some states (e.g. Maryland, Kansas, and California) require one staff member to take care of no more than 3 or 4 toddlers, while other states (e.g. South Carolina, Idaho) allow one staff member to take care of as many as 8 to 12 toddlers. As for the education requirements, states range from imposing no educational requirements on any child care center workers (e.g., Florida, Idaho) to requiring that directors of child care centers have high-school diplomas (e.g., Connecticut, Michigan), to some states (e.g. South Dakota, New Jersey) requiring that child care center directors and teachers have some college education, typically with coursework in child devel-

[13] Most states have two types of child care regulations, those that apply to day care centers, and those that apply to less formal child care setting referred to as "family homes." We limit our analyses to the behavior of child care centers; thus, we focus on the regulations that apply to centers.

[14] Other requirements are on the necessity of developmental curriculum and liability insurance, health and safety standards such as immunization and fire-safety equipment, and general standards such as whether parents are allowed free visits. Some states even specify the frequency of government inspections on licensed child care centers.

[15] Ruopp, et al. (1979) and Mocan, et al. (1995) find evidence that more labor intensive and better qualified child care staff improve the development of young children. (Also see Hayes, et al. (1990) and Blau and Currie (2004) for summaries of these and other studies.) An important exception to these findings is the study by Blau (2000). He finds, using the same data as in the Mocan, et al. (1995) study, that only educational qualifications have an effect on measures of children's development once one controls for center-specific fixed effects.

[16] The information on state child care regulations was gathered by one of the authors (Hotz), in collaboration with Dr. Rebecca Kilburn of Rand for the period 1983-1997. These data are available from the author upon request.

opmental psychology. Over time, the staff-child ratio requirement has fluctuated slightly, with the average stringency increasing modestly from 1987 to 1992 and decreasing modestly from 1992 to 1997. The education requirements have become more stringent over the 10-year period for directors and teachers, while relaxing somewhat for assistants. On average, directors and teachers are required to have one more year of education in 1997 than in 1987.[17] The considerable heterogeneity across states and over time enables us to identify the effects of changes in minimum quality standards on the outcomes of child care establishments.

As Blau (2003) points out, and Currie and Hotz (2004) reconfirm, many of these minimum quality standards are highly correlated with each other. For example, requirements on child-staff ratios tend to move in the same direction of those on the maximum group sizes. The correlation among minimum quality standards makes the attempt to identify the effects of each individual minimum quality standards impossible. To deal with this problem, Blau (2003) creates a summary index of all standards, while most other studies select a few representative standards such as staff-child ratios and staff education requirements (e.g., Chipty and Witte, 1997; Blau, 2004; Currie and Hotz, 2004). To ensure the robustness of our estimates to different measures of minimum quality standards, we examine both the representative standards and a set of separate stringency indexes for minimum staff-to-child ratio[18] and child care staff educational requirements, respectively, similar to those used by Blau. In particular, these stringency indexes are the simple average of staff-child ratio requirements across 6 age groups and the simple average of the numbers of years of schooling required for center directors, teachers, and assistants.[19] Summary statistics for these summary measures are also found in Table 1. For representative standards, we use staff-child ra-

[17] Currie and Hotz (2004) provide details on across-time variations in the staff-child ratio and education requirements.

[18] We use staff-child ratio requirements instead of child-staff ratio requirements for ease of interpretation. The higher the staff-child ratio requirements, the more stringent the minimum quality standards are.

[19] We create stringency indexes this way to avoid the subjectivity of creating a stringency index across different categories of minimum quality standards. For example, it is hard to assign appropriate weights to staff-child ratio versus staff criminal background checks.

tio requirements for a specific age group and the education requirement for teachers.[20]

4.2 Child Care Establishments: Data from the Census of Service Industries, 1987, 1992, and 1997

Every five years the U.S. Census Bureau conducts the Census of Service Industries, a census of all establishments in the service sector. This Census includes data on all child care establishments that have filed federal income tax forms. These establishments primarily focus on the care of children under the age of five where medical or delinquency correction is not a major concern.[21] They do not include baby sitting services provided in the child's home. There are two main types of child care establishments: (1) nonemployer establishments, which are typically owned by an individual and hire no employees; (2) establishments with an employee payroll. In essence, almost all day child care centers fall within the second category of establishments.

Under the Research Data Center program at the U.S. Census Bureau, we obtained access to establishment-level data for all child care establishments with an employee payroll for the Census of Service Industries conducted in 1987, 1992 and 1997.[22] For each establishment, we were given access in a secure site at UCLA run by the Census Bureau to the following information:

- Establishment identifiers: we use the Census File Number (CFN) and Establishment Identification Number (EIN) to match establishments over time and determine the chain-status of an establish-

[20] There are other potentially important quality standards we do not investigate in this study, such as requirements on providers' carrying liability insurance. The major reason is that those standards do not have enough variation across states over time.

[21] The child care industry is classified under the category of social services (SIC code 8351) in the Census. The main three categories are child care services providers, preschools, and Head-Start programs.

[22] Due to confidentiality concerns about non-employer data in the Census of Services, we only obtained access to data on establishments with payroll from the Census Bureau. Non-employer files may contain personal identifiers and are owned by Internal Revenue Services. For use of non-employer data the Bureau needs to initiate discussions with the IRS, which can be costly in the current policy climate. Some researchers may be concerned that the exclusion of non-employer data seriously undermines our study, as informal family-based care constitutes an important part of the child care market. For example, in 1997, 488,734 out of 550,788 child care establishments nationwide were non-employer businesses. We think that this does not significantly undermine our results since employer establishments should be counted as the main source of non-parental child care supply. Although the absolute number of non-employers greatly exceeds that of employers, in terms of the number of enrolled children multiple employer establishments greatly outweigh those with only a single employee. In 1995, 31% of the 21,421,000 children under 6 were enrolled in center-based programs, while 18% were in home-based programs. Moreover, since the NAEYC accreditation applies only to center-based programs, we will not leave out establishments when matching the NAEYC accreditation data with Census of Services establishments, even if we exclude non-employers, which, by nature, are family-based programs.

ment.[23]

- Street address and business names: we use this information to match establishments across data sources. This information comes from the Standard Statistical Establishment List (SSEL), an integrated part of the Census of Service Industries.
- Firm characteristics: legal form of organization, tax-exempt status, operating receipts and revenues, operating expenses, number of employees, payroll, ownership or control, etc.

4.3 Local Child Care Markets and their Demographic Characteristics

Market-level heterogeneity plays a central role in determining the supply side of the child care market. Providers are more likely to enter markets with potentially high profitability. Child care markets are very localized markets geographically. Few parents will travel more than fifteen miles to send their children to daycare (Chipty, 1995; Hofferth et al., 1991). Based on the 2000 population Census, a typical zip code covers a radius of 3 to 4 miles, roughly consistent with the area that a child care center could cover. Other possible geographic boundaries such as cities, counties, or metropolitan statistical areas are too large relative to the service area of a daycare center to use in defining the relevant market. This makes zip code areas the finest approximation of local markets in the child care market.

We use zip code level demographics characteristics taken from the 1990 and 2000 Population Census to control for factors that influence the demand and supply of market-level child care services. In our analyses below, we control for such things as: the ethnic mix, income and of the local population; the percentage of population living in rural areas; the number of children under age 5; indicators of the typical household composition (e.g., the average number of people in a household and whether it is female-headed), labor market conditions (e.g., the percentage of females over 16 not working and the local unemployment rate), and indicators of commuting patterns (the percentage of the working population over 16 working at home and spending more than 40 minutes commuting).

[23] We define establishments sharing the same EIN in the same Census year as affiliated with a chain. A chain has as few as 2 establishments to as many as around 1000 establishments in the data.

4.4 Measuring the Quality of Child Care Services: NAEYC Accreditation

One of the central objectives of this study is to analyze the effects of child care regulations on the quality distribution of the child care services. There is a growing consensus that one measure of whether a child care center provides high-quality services is whether or not it is accredited.[24] The National Association of Education for Young Children (NAEYC) has administered a national accreditation system for almost two decades.[25] Any early childhood program—child care center, preschool, kindergarten, or before- and/or after-school program—can voluntarily apply for NAEYC accreditation. The applying program needs to engage in an extensive self-study based on the Academy's Criteria for High Quality Early Childhood Program.[26] A team of trained volunteer validators verify the accuracy of the program's self-study during a site visit to the program. A 3-member national commission composed of recognized experts in child care and early childhood education then reviews the validated self-study and grants accreditation for a three-year period to centers judged to be in substantial compliance with the Academy's Criteria. Included in the criteria for accreditation are assessments of the nature and extent of interactions among teachers and children, a center's curriculum, the relationships between teachers and families, staff qualifications and professional development, the quality of a center's administration, center staffing and the extent of staff turnover, a center's physical environment, whether a center meets various health and safety

[24] The 1988 National Child Care Staffing Study (Whitebook, Howes, and Philips 1989) examined the quality of care in 227 child care centers representing 643 classrooms in five U.S. metropolitan areas and found that accredited centers provided higher-than-average-quality services to children, assessed with the Early Childhood Environment Rating Scale. They found that accredited centers had better-trained staff and lower staff turnover, and provide more developmentally appropriate activities and higher-quality care giving. The 1993 Cost, Quality and Child Outcomes Study examined 401 child care centers representing 749 classrooms in four states and confirmed the findings of the previous study. Parents were willing pay a premium for the accreditation status, especially for newly opened centers where parents had no provider reputation to rely on (Xiao, 2005).

[25] NAEYC is the only national accreditation body for center-based child care programs. The National Association for Family Childcare (NAFCC) is a national accreditation body for family-based child care programs. We do not incorporate NAFCC accreditation into this study because NAFCC did not start accreditation until 1988 and for various reasons very few family care providers were accredited for the first few years. Then the NAFCC spent 3 years building a new accreditation system from scratch in 1994, and started its operation of the new system nation wide only in 1999. Thus NAFCC accreditation does not fit into the time span of our study (1987-1997) and data target (we only use data for establishments with payroll, which are very unlikely to be family-based programs). In contrast, NAEYC accreditation grows steadily from 1987 to 1997, and is designed for center-based programs (establishments with payroll).

[26] The Criteria is set by a branch of NAEYC, namely the NAEYC Academy for Early Childhood Program Accreditation.

standards, and the quality of the nutrition and food services it provides. While the accreditation process examines the total program, it places the greatest emphasis on the quality of interactions between staff and children and the developmental appropriateness of the curriculum.

As of the spring of 2001, 7,700 programs, serving more than a half million children, had received NAEYC accreditation. An additional 8,000 programs are in the application process. As of 1997, the last year in our data, around 6,500 programs were accredited. There also significant state-level variations in the distribution of accredited programs and applying programs.

We obtained administrative accreditation records at the center level from the NAEYC which contain information on the accreditation status of individual child care providers over the period 1987-97. The data contains information on the provider's exact address (street address, city, county, state, zip), center characteristics (number of staff, number of children, number of groups, length of day, affiliation),[27] and accreditation history (application date, initial accreditation date, expiration date, and accreditation status).[28] With these data, we are able to construct a measure of quality at the establishment level and thereby compensate for the lack of measures of quality in the Census of Services.

4.5 Creating Establishment- and Market-Level Data for Analysis

We performed three sets of merges to construct the unique data set used in this study. First, we merged the state-level regulation data with the Census data, based on the state in which an establishment operates. Second, we matched the NAEYC accreditation database with the Census data, based on the street address and business name of the establishment.[29] Third, we merged the 1990 and 2000 zip code level Census of Population data with the Census of Services, based on the zip code in which an establishment operates.[30] This resulted in a panel dataset with approximately 150,000 establishment-year ob-

[27] Data on center characteristics are of poor quality and unusable for this study.

[28] However, as the application date is updated whenever the establishment submits a new application or a request for renewal, we are not able to determine the number and identity of applicants at a given time.

[29] This match turns out to be less-than-satisfactory. As a result, we also match on the zip code level the number of accredited centers from the NAEYC database with the number of overall establishments from the Census of Services. The appendix offers more details.

[30] The 1990 Census of Population is merged into the 1987 and 1992 Census of Services, and the 2000 Census of

servations, corresponding to more than 10,000 zip-code markets each Census year.

5. Empirical Methodology

Characterized by considerable variation in the quality of services and asymmetrical information between consumers and sellers, the child care market is subject to minimum quality standards that vary across states and over time. NAEYC accreditation offers an indicator of quality child care. This market, with a unique panel data set we assemble, appears to be superbly suited for conducting an empirical investigation of the effects of minimum quality standards on seller behavior.

In this section, we present our empirical methodology and report summary statistics from the data. We leave the appendix to explain the construction of the outcome and independent variables, especially the ones not directly available from the Census of Services, i.e. entry and exit indicators.

5.1 Econometric Strategies for Estimating Effects of Minimum Quality Standards

As we noted in the Introduction, there is a potential for bias in the estimated impacts of minimum quality standards that arises from a number of distinct, but related, reasons. For example, the degree to which parents are concerned about the quality of child care services may vary across states. States with a high proportion of parents who care about quality may, all else equal, be more willing to push for and support more stringent regulation. Failure to account for the across-state differences in parental preferences would result in biased estimates of the effects of state minimum quality standards. Alternatively, states may differ with respect to various dimensions of their work forces, including their skill-levels and the degree of unionization, which could give rise to differences in the labor costs of child care services. Such factors are likely to be associated with the extent to which states regulate different occupations and industries, including the child care industry or industries with which it competes for workers. Again, failure to adequately control for such factors could result in biases when estimating the effects of state minimum quality standards using standard regression methods.

Population is merged into the 1997 Census of Services.

The same reasoning applies to unmeasured time-specific factors, which may influence child care demand, supply, and regulation at the same time. We are mainly concerned with the potential endogeneity bias caused by unobserved time-specific labor market conditions, which affect the child care supply side and regulatory environment simultaneously. For instance, it is possible that in 1987 a greater portion of immigrants are unskilled workers – who are more likely to be employed as child care workers – than in 1997. This fact might have increased the supply of child care while at the same time causing a greater regulatory effort from policy makers in order to control the child care market.

One econometric strategy to help mitigate such biases is to control for state- fixed and time- fixed effects. A necessary condition for this strategy to work is that minimum quality standards vary over time within at least some states and vary across states within time. As we noted in Section 4.1, states vary substantially in the stringency of their child care regulations. Furthermore, states have changed their regulations frequently enough, making it possible to use variation over time within states to control for state-fixed effects and to use variation across states within time to control for time- fixed effects. We exploit this across-state and over-time variation in state regulations to examine the impact of minimum quality standards on the supply side of the child care market.

To characterize our empirical specifications, we adopt the following notations:

MQS_{st}: Minimum quality standards (either the summary indexes of regulatory stringency, or the representative standards) in state *s* at time *t*.

$Demographics_{mt}$: Demographic variables in market *m* at time *t*. See Table 5 from the second row on for the set of zip code level variables we include.[31]

$Firm_{jt}$: Firm attributes for establishment *j* at time *t*, including 6 dummy variables: whether the establishment is owned by a corporation, by an individual, or by a partnership; whether or not all or part of its income is exempt from federal income taxes; whether or not it operates less than 3 months in a year; and lastly, whether or not it

[31] Note we use the natural log of the population under 5 and median household income instead of the two variables themselves.

belongs to a chain.

α_s, β_s and γ_s: State fixed effects.

δ_t, ω_t and κ_t: Time fixed effects.

At the market level, we run the following regressions:

$$Y_{mt} = \alpha_o + \alpha_1 MQS_{st} + \alpha_2 Demographics_{mt} + \alpha_s + \delta_t + \varepsilon^1_{mt},$$

where Y_{mt} are the market-level outcome variables of interest in this study, including the number of establishments, the number of child care employees, and the entry rate and accreditation rate. At the establishment level, we run the following regressions for binary outcomes:

$$\Pr(Y_{jt}) = \beta_0 + \beta_1 MQS_{st} + \beta_2 Firm_{jt} + \beta_3 Demographics_{mt} + \beta_s + \omega_t + \varepsilon^2_{jt},$$

where Y_{jt} are the establishment-level binary outcome variables, including the establishments' exit decisions and accreditation status. We use both the linear probability model and the Logit model.[32] We run the following regressions on continuous establishment-level outcome variables:

$$Y_{jt} = \gamma_0 + \gamma_1 MQS_{st} + \gamma_2 Firm_{jt} + \gamma_3 Demographics_{mt} + \gamma_s + \kappa_t + \varepsilon^3_{jt},$$

where Y_{jt} represents the number of employees, revenues, wages per worker, revenue per worker, and profits per worker.[33]

The coefficients of interest, α_1, β_1 and γ_1, measure the impact of minimum quality standards on the outcomes considered. In all three sets of regressions, we estimate the variance matrix taking into account unobserved heterogeneity influencing seller behavior at the market-year level. Specifically, we al-

[32] As we will show in section 6, the linear probability model and the Logit model produce very similar results. We report both set of estimates because of the comparative advantages and disadvantages of these two models. Including fixed-effects, produces consistent estimates in a linear regression, although not in a nonlinear regression due to the "incidental parameter" problem. Although for each state or each year, the number of observation units (zip codes or establishments) is large enough that the "incidental parameter" problem is greatly mitigated, we error on the side of caution by reporting the results from both the linear probability and Logit models. A nonlinear (Logit) model is more appropriate for a binary outcome than a linear model.

[33] We also investigate the differential impact of minimum quality standards on different types of child care centers. For example, minimum quality standards may have a greater impact on recent entrants' survival probability. We can assess these differential impacts by allowing minimum quality standards to interact with firm characteristics. We do not report results in this draft, partly because only 1992 Census establishments will allow us to determine the entry status (from 1987 data) and the exit status (from 1997 data), which rules out the possibility of including state or time fixed effects.

low the error terms to cluster by market-year group, that is, we allow each market-year group to have a different and unrestricted covariance structure but assume that errors are uncorrelated across groups (Moulton, 1986).

5.2 Descriptive Statistics

Tables 2 through 5 contain the summary statistics from the data set we have constructed. Table 2 describes the variables directly from the Census of Services. Several interesting patterns characterize the child care industry. First, the number of child care establishments has dramatically increased over the 15-year period we analyze, rising from 40,631 in 1987 to 51,305 in 1992 to 61,884 in 1997. Second, there are notable differences and different trends in the forms of ownership in this industry. For example, approximately one-half of child care establishments are owned by corporations, with another third owned by individuals, and only a small proportion by owned by partnerships. Roughly one third of the establishments are tax exempt, around 8.5% operate less than 3 months a year, and about 20% have more than one site (belong to a chain). These firm-level attributes remain quite stable over time, even as the market has grown significantly over the 10-year span. Finally, we note that child care establishments have grown larger in size over time, as reflected by the rising number of employees as well as rising real revenues and payrolls.

Table 3 summarizes the entry and exit of establishments in the child care industry as well as their average wages, revenues and profits per worker and the incidence of accreditation for the three years of Census of Services data we analyze. As shown in the table, significant entry and exit characterize the child care market. In a given year, about 50% of the establishments operating have entered in the previous 5 years, while about 38% of them will exit in the next 5 years. The real wages per worker, the real revenue per worker, and the real profit per worker have all increased significantly over the decade.

Table 4 describes the child care market at the aggregate zip code level. In 1987, child care establishments operated in roughly one third of all U.S zip codes, and by 1997 in roughly half of these zip

codes.[34] On average, three to four child care establishments operate per zip code, about two of which have entered in the last five years, and one to two of which will exit in the next five years. Table 5 describes, from the 1990 and 2000 Census of Population, the demographics of the zip codes in which child care establishments operate. They tend to be more heavily populated, wealthier, better-educated, and less-rural zip codes than the average U.S. zip code.

A discrepancy exists between Tables 3 and 4: we report a significantly lower mean of the accreditation rate in Table 3 than in Table 4. This occurs because in Table 3 we set the accreditation status of an establishment to be one when there is a match between the Census establishment and the NAEYC accredited establishment, and zero otherwise. As explained in the appendix, the address and name matching between the Census and the NAEYC accreditation database is far from perfect. As a result, we incorrectly record many accredited Census establishments as un-accredited and thus Table 3 underestimate the accreditation rates. We base the accreditation rate presented in Table 4 on zip code level aggregation and matching, which captures the actual accreditation likelihood much more accurately. As shown in Table 4, only 0.8% of child care establishments were NAEYC accredited in 1987. Over the next decade NAEYC accreditation grew steadily and significantly: 3.5% of establishments were accredited in 1992 and 7.8% in 1997. Still, only a small proportion of establishments have received accreditation, which partially reflects the fact that the accreditation status serves as an indicator of high-end child care services.

6. Results

Tables 6 through 16 present results on the effects of minimum quality standards. To conserve the length of the paper, we only report the coefficients for the minimum quality standards variables. For every table, we include two panels: the upper panel (Panel A) reports coefficients from the regressions using the summary indexes of staff-child ratio and education requirements; the bottom panel (Panel B) reports coefficients from the regressions using the staff-child ratio requirement for infants and education requirements

[34] There are slightly more than 30,000 U.S. zip codes.

for teachers.[35] Unless otherwise noted, we report four specifications for every table: OLS baseline regression, regression with time fixed effects, with state fixed effects, and with both time and state fixed effects.

A few generalities arise from a brief overview of our findings. The results with and without state- and time- fixed effects paint drastically different pictures of the impact of minimum quality standards, which confirms our suspicion that previous studies using cross-sectional data produced questionable results. We find that the results often switch signs, for example, going from negative and significant to positive and significant when we control for state and time fixed effects. We do not find, as in Blau (2004), that controlling for fixed effects systematically tend to reduce the statistical significance of our estimates. Regulations do have effects on firm behavior, even after we control for these fixed effects![36] The results are not very sensitive, however, to whether we use the average measure of minimum quality standards or individual ones.

6.1 Effects on the Supply of Child care Services

The theoretic literature all points out that binding minimum quality standards will reduce the aggregate supply of regulated products or services. We consider the number of establishments per zip code a straightforward measure of the aggregate supply of child care services in a local market. Our hypothesis is that there will be fewer providers in a local market if minimum quality standards indeed deter entry and/or promote exit. However, providers may change their size in response to different levels of regulatory stringency. To ensure that this re-optimization effect does not cloud the interpretation of the results on the number of establishments per market, we also investigate the effects of minimum quality standards on the sizes of establishments. We use the number of employees and annual revenue per worker as measures of the size of a child care establishment.[37] If providers enroll more children under more stringent minimum quality standards, the staff-child ratio standards mechanically require them to hire more em-

[35] We have tried other single measures of staff-child ratio and education requirements and found similar results.

[36] In this sense, our results are closer to the findings of Currie and Hotz (2004).

[37] Previous studies (Gormley, 1991; Lowenberg and Tinnin, 1992) use the number of child care slots available per child in licensed programs as a measure of the supply in that child care market. We have neither data on the capacity nor the number of enrolled children necessary to perform such analyses.

ployees.[38]

Again, because of the mechanical relationship between the number of staff members and the number of children in care, we aggregate all child care employees at the zip code level to form another measure of child care supply. Minimum quality standards may reduce the number of child care providers (employers), or affect the providers' optimal number of employees. Either way, such standards will affect the number of child care workers serving the local market. As these standards put an upper bound on the number of children a staff member can take care of, a decrease in the number of child care workers serving a local market means a direct reduction of the local market's capacities to serve children in need of non-parental care.

Table 6 presents results on the effects of changes in minimum quality standards on the number of child care establishments per zip code. The regressions with both state- and time- fixed effects show that higher staff-child ratio requirements significantly reduce the number of establishments operating per zip code. According to the estimates in Panel A Column 4, requiring the states with average staff-child ratio requirements (that is, 1 staff member can take care of up to 7 to 8 children, or a required staff-child ratio of 0.134) to raise the ratio by a standard deviation (that is, 1 staff member for every 6 children) would have driven out about approximately one third of a child care establishment per zip code.[39]

The negative effect of higher education requirement, however, disappears when we add in state-fixed effects. The baseline OLS regression and the regression including time- fixed effects both generate a significantly negative coefficient on the education requirement variable. In the regression including both time- and state- fixed effects, however, the coefficient becomes insignificant. It seems that education requirements are not binding in terms of reducing supply.

The decrease in the number of child care establishments does not necessarily indicate a decrease

[38] The effects on the size of revenues are not as clear-cut because providers may lower prices as minimum quality standards alter the nature and intensity of competition among providers. Therefore, we need to interpret the coefficients in the regression using revenues as the outcome variable with caution.

[39] Here is how we derive this number: (change in the stringency of *MQS*) × the coefficient in Column (4) = 0.027 × (-11.364) = -0.027 × 11.364 = -0.307. All subsequent calculations on the magnitudes of effects follow the same method.

in supply of child care services, as establishments may expand under the more stringent regulatory environment. Table 7, which reports results for regressions using the number of employees and the size of revenues to proxy for the size of the establishment, shows us otherwise.[40] A higher staff-child ratio requirement decreases the work force while having no effect on revenues. A higher education requirement has no effect on the work force but significantly reduces revenues. Because of the mechanical relationship between the numbers of staff members and children specified by the staff-child ratio requirements, we conclude there is no evidence at all that child care establishments expand under more stringent standards. On the contrary, it seems that providers respond to higher staff-child ratio requirements by downsizing. This downsizing effect points to an even larger negative effect of these regulations on the supply of child care services.

In Table 8, which presents estimates of the effects on the number of child care employees per zip code, provides further evidence that minimum quality standards reduce supply. Column 4 indicates that requiring the states with average staff-child ratio requirements to raise the ratio by a standard deviation would have reduce the number of child care workers in a market by between 3 to 4. We attribute this large downsizing effect to two channels: one establishment would have gone out of business every three zip codes, which would have cost about 9 to 10 jobs for these three zip codes, or an average of 3 jobs for each zip code; the other two or three establishments operating in the zip code would have lost 1 or 2 jobs together. Considering the number of children these laid-off employees could have taken care of, there is no doubt that the staff-child ratio requirement has a substantial negative effect on the supply of child care services. Again, the education requirement has no significant effect on the child care workforce.

6.2 Effects on Firm Entry

Do minimum quality standards reduce child care by serving as entry barriers? Table 9 presents the results for the effect of minimum quality standards on entry rates at the zip code level. Again, the results for the staff-child ratio and education requirements diverge. Higher staff-child ratio requirements

[40] To save space, we only report coefficients for the OLS baseline regression and the regression with both state- and time- fixed effects.

significantly reduce entry rates, while higher education requirements have no such effect, as shown in the regressions with both state- and time- fixed effects. In terms of magnitude, staff-child ratio requirements present quite sizable entry barriers. According to the estimates in Column 4, requiring the states with average staff-child ratio requirements to raise the ratio by a standard deviation would have lowered the entry rate by 23%, that is, in these states about one entrant in each zip code would have chosen not to enter if faced with the average stringent staff-child requirements.

6.3 Effects on Firm Exit

Tables 10 and 11 present the estimates of the marginal effects of a change in minimum quality standards on the probability of exit of a child care establishment. Table 10 reports results from linear probability models, while Table 11 presents estimates of marginal effects derived from Logit models. Table 12 presents estimates on the exit rate at the zip code level. The theoretical literature predicts that exit likelihood will rise with minimum quality standards that are more stringent. However, the estimation results are surprising: in the regressions with both state- and time- fixed effects, higher education requirements significantly promote exit, while higher staff-child ratio requirements seem to have just the opposite effect. The results are also economically significant. For example, requiring the states with average staff-child ratio requirements to raise the ratio by a standard deviation would have decreased the likelihood of exit by roughly 4% to 5%, while requiring states to increase education requirements from 9 years to 12 years (that is, requiring a high school diploma) would have increased the likelihood of exit by roughly 1.2% to 1.5%.[41]

Combining these results with findings about supply and entry rates, it seems that minimum staff-child ratios serve as an effective entry barrier but staff education requirements do not. These two types of standards also have opposite effects on establishments' propensity to exit. We suspect that this is due to the different roles of the quantity and quality of labor play in the child care market. We need to place the child care market and its input use in the broader labor market to understand the implications. We will try

[41] The numbers are based on Column 4, Panel A of Tables 10 and 11.

to reconcile these conflicting results in section 6.6.

6.4 Effects on Quality

Accreditation represents a much higher quality standard than state mandated minimum quality standards. That is, child care establishments seeking accreditation are unlikely facing binding state regulation. However, as Ronnen (1991) predicts, firms at the higher end of quality distribution may respond by increasing the quality of their services in an attempt to alleviate the degree of competition with their regulated rivals. As shown in figure 1, minimum quality standards may create a spike in the number of establishments providing quality levels just satisfying the minimum standards, or the distribution of quality in a market may unambiguously improve if original higher-quality establishments seek even higher quality out of strategic considerations. In the former case, the stringency of minimum quality standards should not affect the probability of an establishment being accredited, as the accreditation threshold is far higher than minimum quality standards. However, in the latter case, the probability of an establishment being accredited should rise as the whole distribution of quality shifts up and more firms fall into accreditation levels of quality. No clear evidence on this effect exists in previous work. However, researchers have noticed that "a correlation appears between states having higher licensing standards and having larger numbers and higher proportions of accredited programs, such as in Connecticut, Illinois, Massachusetts, Minnesota, and New York." (Bredekamp and Glowacki, 1996).

Tables 13 and 14 present the estimated marginal effects of minimum quality standards on an establishment's probability of receiving NAEYC accreditation from linear probability models and Logit models respectively. As shown in both tables, higher staff-child ratio requirements significantly increase the probability of receiving accreditation, while higher education requirements have the opposite effect. Imperfect matching makes the magnitudes in these two tables untrustworthy, however. Table 15 presents the estimated effects of minimum quality standards on the accreditation rate at the zip code level. The coefficients have the same signs as in Tables 12 and 13, while having substantially greater magnitudes as we expected. According to Column 4 in Panel A, requiring the states with average staff-child ratio re-

quirements to raise the ratio by a standard deviation would have increased the accreditation rate by about 2.7%, while requiring states to increase education requirements from 9 years to 12 years would have decreased the accreditation rate by 0.9%.

These results, first, illustrate the far-reaching effects of minimum quality standards on firms' quality choices in a market with differentiated products. When minimum quality standards effectively serve as entry barriers (as in the case of the staff-child ratio requirement), they seem to move the whole quality curve forward as it appears that originally higher-quality establishments seek even higher quality. Second, these results suggest a tentative explanation for the exit-curbing effect of the staff-child ratio requirements and the exit-inducing role of the education requirements. Suppose it is the case that higher staff-to-child ratios result in higher quality child care, while more educated child care work forces have the opposite effects. Further suppose low-quality providers are more likely to get out of business and high-quality ones survive longer. Then more stringent staff-to-child ratio requirements will promote quality and hence reduce the propensity of firm exit, while more stringent staff educational requirements will reduce quality and hence increase exit.

6.5 Effects on Wages, Revenues and Profits per Worker

Our last set of results show us who wins and loses under more stringent minimum quality standards. The standards may drive revenue up as providers now offer higher-quality services to respond to higher regulatory stringency, and correspondingly charge higher prices.[42] However, consumers may view quality and quantity as substitutes and this would tend to decrease revenues (Blau and Hagy, 1998). Incumbent providers may profit from minimum quality standards, which serve as entry barriers by blocking their low-quality rivals.[43] However, more stringent standards might also increase operating costs, and owners may suffer if demand does not increase accordingly. In terms of workers' benefits, minimum quality standards may drive up wage levels as profitability in the industry rises (or employees need better

[42] Blau and Mocan (2002) find that revenue is positively (though weakly) associated with quality of child care centers, where quality in their study is measured by instruments defined by developmental psychologists.

[43] As Adam Smith pointed out, (occupational licensing) is only to "prevent this reduction of price, and consequently of wages and profit, by restraining that free competition which would most certainly occasion it."

qualifications), however, employees may also suffer a wage loss if employers successfully make them bear the cost of stringent regulations (Blau, 2004).

Table 16 presents the estimated effects of minimum quality standards on wages, revenues, and profits per worker. In this table every two columns report results from a regression with a different dependent variable. Both staff-child ratio and education requirements have no significant effects on wages per worker, which suggest that workers actually lose from higher education requirements, as they are not paid accordingly.[44] Owners of child care establishment seem to benefit from higher staff-child ratio requirements, while losing from higher education requirements. This is consistent with our previous evidence that higher staff-child ratio requirements promote higher-quality services and discourage exit, while higher education requirements just do the opposite. According to Columns 4 and 6 in Panel A, requiring the states with average staff-child ratio requirements to raise the ratio by a standard deviation would have increased revenue per worker by $615 and profit per worker by $497, while requiring states increase education requirements from 9 years to 12 years would have decreased revenue per worker by $420 and profit per worker by $363.[45]

6.6 Discussion

Our estimation results show that the two types of quality requirements have distinctively different effects on almost all outcomes. Minimum staff-child ratio requirements effectively block entry and reduce supply. Meanwhile, these requirements promote quality levels of child care services: child care establishments are more likely to receive accreditation and less likely to exit under higher staff-child ratio requirements. In addition, establishment owners seem to benefit from this type of quality standard by earning higher revenue and profit per employee. Minimum staff education requirements, however, have no effect on entry and lead to lower quality in the provision of child care, as embodied by lower accreditation rates and higher exit rates. Owners lose from the education requirements by receiving lower revenue and

[44] This result is consistent with Blau (2004).

[45] This time panel B gives different results, namely that the requirements on the staff-child ratio for infants do not have significant impacts on revenue and profit per worker, and the requirements on teachers' education do not have a significant impact on revenue per worker.

profit per employee.

The results on staff-child ratio requirements fit the standard theory on minimum quality standards with a Ronnen (1991) adjustment on firms' strategic interaction under imperfectly competitive markets. More stringent staff-child ratio standards create entry barriers in local markets. The entry barriers block the lowest-quality providers from entering, and therefore alleviate competition among incumbent establishments. This competition-alleviation effect is consistent with the later finding that remaining firms in markets with more stringent staff-child ratio standards have higher profits and, as a result, are less likely to exit. To further assuage competition with their regulated rivals, more firms seek accreditation to offer high-end child care services.

The results on staff education requirements, however, conflict with any existing theory on minimum quality standards. Not only are there no entry-deterrence effects, but also these requirements discourage accreditation, lower owner profits, and induce exits. One possible explanation embeds the demand for higher-skilled child care workers in the broad labor market. The child care market typically features low skilled workers with relatively low pay rates. From 1987 to 1997, state governments gradually required higher skills for child care workers. At the same time, there is clear evidence (Autor, Katz and Krueger, 1998) that over the 1980s and 1990s, the demand for higher skilled workers increased, creating better outside opportunities for higher-skilled child care workers. A child care establishment may find less of a problem starting business as there are always qualified workers needing temporary jobs, however, they may find it more difficult to keep higher skilled workers in these jobs.[46] Greater worker turnover, in turn, makes it more difficult for child care establishments to maintain the quality of their services and thus be able to receive or remain accredited. In fact, the NAEYC explicitly includes in its accreditation criteria the degree of staff turnover, where high turnover rates reduce a child care center's accreditation score.[47] Low quality leads to lower owner profits, and results in higher propensity of exiting the businesses.

[46] As the wage rate regressions show, higher education does not pay off in the child care profession.

[47] Child development literature establishes that children need familiarity and steady environment to establish trust and interaction with their care takers.

7. Conclusions

Although evidence on the demand-side effects of minimum quality standards has started to accumulate, the supply-side effects have yet to be explored due to data limitations. As Kleiner (2000) points out, "the empirical evidence (of occupational licensing) on the increase in quality, greater level of training, or avoidance of catastrophes is often thin or nonexistent … The largest barrier standing in the way of analysis of occupational licensing is that there is no well-organized national data set waiting to be explored." Our study fills in the blanks by offering a critical assessment of the impact of minimum quality standards, a type of licensing requirement, on firms' entry, exit, and quality choices using rich panel data at the national level.

To summarize our findings, the two major types of minimum quality standards both bind child care establishments, but in strikingly different ways. Standards setting minimum staff-child ratios regulate the labor intensiveness of child care services. They seem to effectively screen low-quality providers out of the child care market and alleviate competition among incumbent establishments. This selection process promotes quality levels in the child care market: child care establishments are more likely to receive accreditation and less likely to exit under higher staff-child ratio requirements. Moreover, owners seem to benefit from this type of standard in the form of earning higher revenue and profit per employee. Standards setting minimum staff education levels regulate input quality. They have no effect on entry and lead to lower quality child care services, as embodied by lower accreditation rates and higher exit rates. Owners lose from the education requirements by receiving lower revenue and profit per employee. The quality of child care services seems to be more affected by increases in labor intensiveness than by increasing the number of well-educated care givers. Regulating staff-child ratios works better than regulating education requirements. Overall, the evidence tends to support regulations requiring increased labor intensiveness instead of those requiring higher education levels of staff members.

Our findings, especially those on the discrepancy between the two types of minimum quality

standards, shed light on at least two important limitations in the theoretic literature on the effects of such regulations. First, existing theory seems to downplay the strategic and dynamic nature of firm competition under government intervention. As illustrated in our findings, firms not directly regulated also strategically choose optimal quality levels and this re-optimization has a direct impact on exit dynamics. Second, existing theory fails to fall under a general equilibrium framework. Qualification requirements on labor (or any mobile input) have complex effects if we consider the broad outside market and allow the mobility of labor across industries and occupations.

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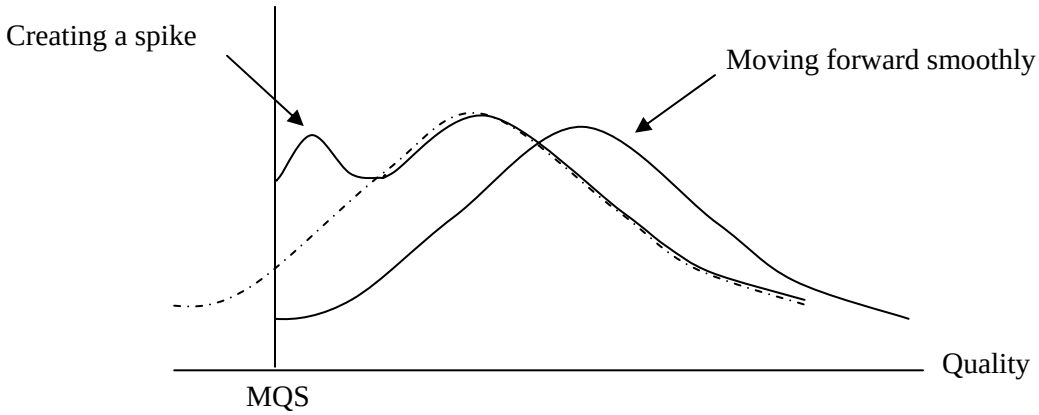
Figure 1: The Potential Impact of Minimum Quality Standards on Quality Distribution



.-.-.-.- quality distribution without MQS
_____ quality distribution with MQS

Table 1: Child care Minimum Quality Standards, By State

Type of MQS	Minimum Quality Standards	Mean	St. Dev.	Min	Max	1987 Mean	1992 Mean	1997 Mean
Labor Intensiveness	Minimum staff-child ratio (0-11 months)	0.226	0.047	0.125	0.333	0.225	0.226	0.229
	Minimum staff-child ratio (11-23 months)	0.192	0.052	0.083	0.333	0.193	0.190	0.192
	Minimum staff-child ratio (24-35 months)	0.137	0.047	0.083	0.250	0.139	0.137	0.138
	Minimum staff-child ratio (36-47 months)	0.095	0.018	0.067	0.143	0.095	0.095	0.095
	Minimum staff-child ratio (48-59 months)	0.082	0.018	0.050	0.125	0.082	0.081	0.082
	Minimum staff-child ratio (60+ months)	0.069	0.022	0.040	0.200	0.071	0.068	0.068
	Average Minimum Staff-child Ratio	0.134	0.027	0.082	0.196	0.134	0.133	0.134
Staff Qualifications	Education (years of school) required for directors	11.975	4.697	0	16	11.148	12.280	12.392
	Education (years of school) required for teachers	8.662	5.896	0	16	7.932	8.820	9.137
	Education (years of school) required for assistants	3.593	5.355	0	14	3.841	3.400	3.569
	Average Educational Requirement	8.077	4.166	0	14	7.640	8.167	8.366

Table 2: Summary Statistics: Characteristics of Child Care Establishments
[Standard Deviations in parentheses]

Variable	Definition	1987 Mean (St. Dev.)	1992 Mean (St. Dev.)	1997 Mean (St. Dev.)	Percentage Change, 1987-97
Corporation	Whether the establishment is owned by a corporation: = 1 if yes; = 0 otherwise.	0.492 (0.500)	0.514 (0.500)	0.536 (0.499)	8.2%
Individual	Whether the establishment is owned by an individual: = 1 if yes; = 0 otherwise	0.307 (0.461)	0.317 (0.465)	0.310 (0.463)	1.0%
Partnership	Whether the establishment is owned by a partnership: = 1 if yes; = 0 otherwise.	0.040 (0.197)	0.028 (0.165)	0.034 (0.181)	-17.6%
Tax Exempt	Whether all or part of the income of the establishment is exempt. from federal income taxes: = 1 if yes; = 0 otherwise	0.340 (0.474)	0.311 (0.463)	0.292 (0.455)	-16.4%
Chain	Whether the establishment belongs to a chain: = 1 if yes; = 0 otherwise.	0.185 (0.389)	0.209 (0.407)	0.215 (0.411)	14.0%
Part Year	Whether the establishment operates less than 3 months in a year: = 1 if yes; = 0 otherwise.	0.085 (0.279)	0.086 (0.281)	0.084 (0.278)	-1.2%
# Employees	Number of employees	8.739 (11.942)	9.121 (13.362)	10.143 (15.353)	13.8%
Revenue	Total Revenue (in 1000s of 1997 $)	$180.029 (323.754)	$199.830 (448.376)	$228.793 (463.057)	21.3%
Payroll	Total Payroll (in 1000s of 1997 $)	$88.542 (153.643)	$96.525 (195.259)	$112.417 (205.110)	21.2%
N	Number of observations	40,631	51,305	61,884	

Table 3: Summary Statistics: Entry, Exit, Costs, Revenues, Profits and Accreditation Status of Child Care Establishments

Variable	Definition	1987 Mean (St. Dev.) [Sample Size]	1992 Mean (St. Dev.) [Sample Size]	1997 Mean (St. Dev.) [Sample Size]
Entry	Whether the establishment exists at t - 5: = 0 if yes; = 1 otherwise.	*n.a.*	0.519 (0.500) [51,305]	0.483 (0.500) [61,884]
Exit	Whether the establishment exists at t + 5: = 1 if yes; = 0 otherwise.	0.387 (0.487) [40,631]	0.381 (0.486) [51,305]	*n.a.*
Wage per worker	Payroll / # Employees	8.935 (4.480) [37,745]	9.538 (6.222) [47,154]	10.011 (6.189) [56,480]
Revenue per worker	Revenue / # Employees (in 1000s of 1997$ per worker)	$19.531 (11.632) [37,745]	$22.819 (21.498) [47,154]	$23.315 (18.332) [56,480]
Profit per worker	(Revenue – Payroll) / # Employees (in 1000s of 1997 $)	$10.596 (9.095) [37,745]	$13.280 (18.510) [47,154]	$13.305 (15.335) [56,480]
Accredit	Whether the establishment is NAEYC accredited: = 1 if yes; = 0 otherwise.	0.003 (0.057) [40,631]	0.017 (0.128) [51,305]	0.038 (0.191) [61,884]

Notes: The low accreditation averages reported in this table reflect imperfect matching. We set unmatched establishments' accreditation status to zero.

Table 4: Summary Statistics: Supply and Quality of Child Care at the Market Level

Variable	Definition	1987 Mean (St. Dev.)	1992 Mean (St. Dev.)	1997 Mean (St. Dev.)
# Establishments	Number of child care establishments in a zip code.	3.44 (3.320)	3.734 (3.522)	4.023 (3.864)
Establishment Density	# Establishments / # Children under 5.	0.007 (0.049)	0.008 (0.075)	0.009 (0.045)
# Entrants	Number of establishments which do not exist at t - 5.	*n.a.*	1.942 (2.108)	1.942 (2.144)
Entry Rate	# Entrants at t / # Establishments at t – 5.	*n.a.*	0.691 (0.802) [N=10,388]	0.661 (0.744) [N=12,503]
# Exits	Number of establishments which do not exist at t + 5.	1.33 (1.617)	1.423 (1.695)	*n.a.*
Exit Rate	# Entrants at t / # Establishments at t.	0.383 (0.364)	0.378 (0.356)	*n.a.*
# Accredited	Number of establishments which are NAEYC accredited.	0.027 (0.186) [N=11,404]	0.146 (0.478) [N=13,285]	0.346 (0.840) [N=14,840]
Accreditation Rate	# Accredited / # Establishments	0.008 (0.069) [N=11,404]	0.035 (0.131) [N=13,285]	0.078 (0.198) [N=14,840]
N	# of zip codes	11,405	13,306	14,964

Table 5: Summary Statistics: Demographics Characteristics of Child Care Markets

Variables	Definition	1990 Mean (St. Dev.)	2000 Mean (St. Dev.)
Population	Total Population in a zip code	16,169 (14,631)	16,579 (15,254)
Under 5	Population under Age 5	1,191 (1,199)	1,136 (1,197)
% Black	% Population that are African American	0.096 (0.176)	0.101 (0.180)
% Hispanic	% Population that are Hispanics	0.059 (0.126)	0.082 (0.147)
Household Size	Average household size	2.731 (0.406)	2.585 (0.345)
Median Income	Household median income	31,060 (12,656)	43,674 (17,259)
% Poverty	% Population under poverty line	0.123 (0.092)	0.115 (0.082)
% College	% Population over age 25 with some college education	0.307 (0.109)	0.352 (0.104)
% Female Head with Child	% Female-headed households with children.	0.058 (0.037)	0.066 (0.036)
% Female Not Working	% Female over age 16 not working	0.379 (0.092)	0.37 (0.085)
% Unemployed	% in labor force that are unemployed	0.062 (0.037)	0.057 (0.042)
% Work at Home	% Working population over age 16 working at home	0.036 (0.035)	0.037 (0.027)
% Long Commute	% Working population over age 16 spending more than 40 minutes commuting	0.282 (0.138)	0.322 (0.141)
% Rural	% Population living in rural areas	0.405 (0.414)	0.381 (0.403)
N	Number of zip codes	13,306	14,964

Table 6: Estimated Effects of Minimum Quality Standards on the Number of Establishments per Market
[*N* = 39,675 Zip-Code Market – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-0.392	0.102	-6.205	-11.364
	(0.583)	(0.586)	(2.975)**	(2.983)***
Average Education Requirement	-0.037	-0.035	0.027	-0.007
	(0.004)***	(0.004)***	(0.016)*	(0.016)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.38	0.39	0.39	0.40
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-0.270	-0.104	-3.977	-5.947
	(0.330)	(0.329)	(1.316)***	(1.323)***
Educ. Requirement for Teachers	-0.015	-0.015	0.035	-0.00007
	(0.003)***	(0.003)***	(0.011)***	(0.011)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.38	0.39	0.39	0.40

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Estimated Effects of Minimum Quality Standards on the Size of Establishments
[*N* = 149,107 Establishment – Year Observations]

	No. of Employees per Establishment		Revenue (in thousands of $)	
	(1)	**(2)**	**(3)**	**(4)**
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-16.474	-15.820	34.534	326.638
	(1.564)***	(8.838)*	(58.748)	(248.525)
Average Education Requirement	0.109	0.042	3.130	-1.588
	(0.008)***	(0.033)	(0.246)***	(0.891)*
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	Yes	No	Yes
R-squared	0.31	0.31	0.32	0.32
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-12.534	-6.177	-74.756	-62.835
	(0.850)***	(3.430)*	(32.951)**	(89.751)
Educ. Requirement for Teachers	0.069	0.017	1.897	-0.499
	(0.006)***	(0.019)	(0.175)***	(0.487)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.12	0.12	0.09	0.09

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Estimated Effects of Minimum Quality Standards on the Number of Child care Employees per Market
[*N* = 39,675 Zip-Code Market – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-25.507	-20.741	-82.822	-135.448
	(9.120)***	(9.135)**	(44.154)*	(43.969)***
Average Education Requirement	0.109	0.123	0.498	0.087
	(0.049)**	(0.050)**	(0.208)**	(0.209)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.38	0.39	0.39	0.40
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-27.336	-25.979	-45.029	-63.075
	(4.959)***	(4.956)***	(18.724)**	(18.755)***
Educ. Requirement for Teachers	0.146	0.135	0.451	0.032
	(0.035)***	(0.035)***	(0.128)***	(0.130)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.31	0.31	0.32	0.32

Notes: Zip code-year clustered robust standard errors are reported in parenthesis for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Estimated Effects of Minimum Quality Standards on Entry Rate per Market
[*N* = 22,891 Zip-Code Market – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	0.531	0.569	-8.217	-8.378
	(0.204)***	(0.206)***	(2.248)***	(2.271)***
Average Education Requirement	-0.005	-0.005	0.022	0.022
	(0.001)***	(0.001)***	(0.017)	(0.017)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.02	0.02	0.04	0.04
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	0.168	0.181	-2.157	-2.204
	(0.115)	(0.116)	(0.587)***	(0.594)***
Educ. Requirement for Teachers	-0.003	-0.003	0.002	0.002
	(0.001)***	(0.001)***	(0.006)	(0.006)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.02	0.02	0.04	0.04

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10: Estimated Effects of Minimum Quality Standards on Probability of Exit: Linear Probability Model
[*N* = 88,105 Establishment – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-0.194	-0.184	-1.544	-1.542
	(0.064)***	(0.065)***	(0.349)***	(0.349)***
Average Education Requirement	-0.003	-0.003	0.004	0.004
	(0.000)***	(0.000)***	(0.002)**	(0.002)**
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.10	0.10	0.10	0.10
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-0.078	-0.072	-0.745	-0.746
	(0.037)**	(0.037)*	(0.192)***	(0.192)***
Educ. Requirement for Teachers	-0.002	-0.002	0.003	0.003
	(0.000)***	(0.000)***	(0.001)**	(0.001)**
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.10	0.10	0.10	0.10

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 11: Estimated Effects of Minimum Quality Standards on Probability of Exit: Logit Model
[*N* = 88,105 Establishment – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-0.212	-0.199	-1.701	-1.699
	(0.072)***	(0.072)***	(0.349)***	(0.349)***
Average Education Requirement	-0.003	-0.003	0.005	0.005
	(0.0004)***	(0.0004)***	(0.002)***	(0.002)***
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.076	0.076	0.080	0.080
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-0.086	-0.078	-0.799	-0.800
	(0.041)**	(0.041)*	(0.184)***	(0.184)***
Educ. Requirement for Teachers	-0.002	-0.002	0.003	0.003
	(0.0004)***	(0.0004)***	(0.001)**	(0.001)**
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.076	0.076	0.080	0.080

Notes: The marginal effects of variables on probability of exit are reported. Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 12: Estimated Effects of Minimum Quality Standards on Exit Rate per Market
[*N* = 24,542 Zip-Code Market – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-0.760	-0.739	-2.145	-2.173
	(0.087)***	(0.088)***	(0.465)***	(0.466)***
Average Education Requirement	-0.003	-0.003	0.004	0.004
	(0.001)***	(0.001)***	(0.002)*	(0.002)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.02	0.02	0.04	0.04
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-0.308	-0.294	-1.159	-1.154
	(0.051)***	(0.051)***	(0.254)***	(0.254)***
Educ. Requirement for Teachers	-0.003	-0.003	0.004	0.003
	(0.000)***	(0.000)***	(0.002)**	(0.002)**
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.02	0.02	0.04	0.04

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 13: Estimated Effects of Minimum Quality Standards on Accreditation: Linear Probability Model
[*N* = 149,107 Establishment – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	-0.019	-0.014	0.422	0.304
	(0.018)	(0.018)	(0.074)***	(0.072)***
Average Education Requirement	0.0001	0.0001	-0.001	-0.002
	(0.0001)	(0.0001)	(0.000)**	(0.000)***
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.03	0.03	0.04	0.04
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	-0.010	-0.009	0.095	0.055
	(0.010)	(0.010)	(0.033)***	(0.032)*
Educ. Requirement for Teachers	0.0001	0.0001	0.000	-0.001
	(0.0001)***	(0.0001)**	(0.000)	(0.000)***
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.03	0.03	0.04	0.04

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 14: Estimated Effects of Minimum Quality Standards on Accreditation: Logit Model
[*N* = 149,107 Establishment – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	0.013	0.016	0.439	0.277
	(0.009)	(0.007)**	(0.051)***	(0.052)***
Average Education Requirement	0.00002	0.00005	0.001	-0.0003
	(0.00007)	(0.00005)	(0.0003)**	(0.0003)
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
Pseudo R-Squared	0.147	0.167	0.172	0.190
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	0.009	0.010	0.130	0.078
	(0.005)*	(0.004)**	(0.020)***	(0.017)***
Educ. Requirement for Teachers	0.0001	0.0001	0.001	-0.0003
	(0.00005)***	(0.00004)***	(0.0002)**	(0.0002)**
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
Pseudo R-Squared	0.148	0.167	0.171	0.190

Notes: The marginal effects of variables on probability of exit are reported. Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 15: Estimated Effects of Minimum Quality Standards on Accreditation Rate per Market
[*N* = 39,529 Zip-Code Market – Year Observations]

	(1)	(2)	(3)	(4)
Panel A: The Effects of Average Minimum Quality Standards				
Average Staff-Child Ratio	0.091	0.125	1.290	0.987
	(0.030)***	(0.030)***	(0.131)***	(0.126)***
Average Education Requirement	0.0001	0.0002	-0.001	-0.003
	(0.0002)	(0.0002)	(0.001)**	(0.001)***
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.06	0.07	0.08	0.09
Panel B: The Effects of Single Measures of Minimum Quality Standards				
Staff-Child Ratio For Infants	0.060	0.071	0.489	0.373
	(0.017)***	(0.017)***	(0.064)***	(0.063)***
Educ. Requirement for Teachers	0.0004	0.0004	-0.0004	-0.003
	(0.0001)***	(0.0001)***	(0.0004)	(0.000)***
Year Fixed Effects	No	Yes	No	Yes
State Fixed Effects	No	No	Yes	Yes
R-squared	0.06	0.07	0.08	0.09

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 16: Estimated Effects of Minimum Quality Standards on Wages, Revenues, and Profits per Worker
[*N* = 137,032 Establishment – Year Observations]

	Wages per Worker		Revenue per Worker		Profit per Worker	
Panel A: The Effects of Average Minimum Quality Standards						
Average Staff-Child Ratio	7.709	4.354	18.882	22.758	11.173	18.404
	(0.710)***	(2.788)	(2.183)***	(9.379)**	(1.772)***	(7.922)**
Average Education Requirement	0.050	-0.019	0.076	-0.140	0.026	-0.121
	(0.004)***	(0.014)	(0.013)***	(0.040)***	(0.010)**	(0.032)***
Year Fixed Effects	No	Yes	No	Yes	No	Yes
State Fixed Effects	No	Yes	No	Yes	No	Yes
R-squared	0.19	0.21	0.07	0.08	0.05	0.06
Panel B: The Effects of Single Measures of Minimum Quality Standards						
Staff-Child Ratio For Infants	4.403	-1.563	12.843	-0.332	8.440	1.231
	(0.383)***	(1.094)	(1.202)***	(4.078)	(0.978)***	(3.486)
Educ. Requirement for Teachers	0.044	0.002	0.065	-0.044	0.020	-0.046
	(0.003)***	(0.009)	(0.009)***	(0.028)	(0.008)***	(0.023)**
Year Fixed Effects	No	Yes	No	Yes	No	Yes
State Fixed Effects	No	Yes	No	Yes	No	Yes
R-squared	0.19	0.21	0.07	0.08	0.05	0.06

Notes: Zip code-year clustered robust standard errors are reported in parentheses for all tables. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix: Variable Construction

Measures of Entry and Exit

We follow Dunne, Roberts, and Samuelson (1988) to construct aggregate measures of entry and exit rates. We assume that establishments first appearing in the 1992 Census entered between 1987 and 1992 and those first appearing in the 1997 Census entered between 1992 and 1997. As we never observe the pool of potential entrants, we measure entry at an aggregate level. Similarly, we assume that establishments last appearing in the 1987 Census exited between 1987 and 1992, and those last appearing in the 1992 Census exited between 1992 and 1997. We are able to measure exit at both the aggregate and individual level.

We define the following variables:

NE_{mt} = the number of establishments that enter market *m* between census year *t*-5 and *t*;

NT_{mt} = the number of establishments that exist in market *m* at Census year *t*;

NX_{mt} = the number of establishments that exit market *m* between census years *t* and *t*+5;

$Exit_{jt}$ = 1, if establishment *j* exits between census years *t* and *t*+5 and = 0 otherwise.

Using these variables, we define the entry rate for market *m* at Census year *t* as:

$$ER_{mt} = \frac{NE_{mt}}{NT_{m,t-5}}.$$

We define the exit rate for market *m* at Census year *t* as:

$$EX_{mt} = \frac{NX_{mt}}{NT_{mt}}.$$

Measures of Quality

Ideally, if there were a perfect match between the Census of Services and the NAEYC accreditation database, we could just use a Census establishment's (matched) accreditation status as a proxy for high quality. However, in practice the actual match is far from perfect. In all three Census years we can only match approximately 50% of the NAEYC accredited establishments with Census establishments. The main reason for this, we suspect, is that many child care centers have changed their addresses and

business names during our sample period. The Censuses of Services records the addresses and the business names in 1987, 1992, and 1997 respectively, while the NAEYC only keeps the most recent addresses and business names.[1] Because of the imperfect matching, we will incorrectly set many accredited establishments' accreditation statuses to zero. Furthermore, using the matched accreditation status is troublesome unless we are willing to assume that the unmatched accredited establishments do not inherently differ from the matched establishments. To deal with this problem, we construct an alternate measure of the accreditation rate. We aggregate by zip code the number of establishments in the Census and the number of accredited establishments in the accreditation database. We then match the Census and the accreditation database by zip code and define the accreditation rate in market *m* at Census year *t* as:

$$Accreditation\ Rate_{mt} = \frac{\#\ Accredited\ Establishments_{mt}}{\#\ Establishments_{mt}}.$$

This revised definition, though subject to its own measurement errors, captures the actual propensity to seek accreditation more accurately.[2]

Measures of Wages, Revenues, and Profit per Worker

From the Census we observe the payroll and revenues of a child care establishment. We adjust the payroll and revenue variables from nominal values to real values using 1997 as the base year. From the payroll and revenue data we construct a crude measure of profitability, which is:

$$Profit_{jt} = Revenue_{jt} - Payroll_{jt}.^{3}$$

We define wages, revenue, and profits per worker of firm *j* at Census year *t* as:

$$Wages\ per\ Worker_{jt} = \frac{Payroll_{jt}}{\#\,Employees_{jt}},$$

[1] We received the NAEYC database on May 2003, so addresses and business names of child care centers are the year 2003 snapshot.

[2] A potential measurement problem arises if relocation of an establishment involves a different zip code.

[3] A more reasonable definition should have the operating expenses deducted from revenue. However, in the Census more than half of the establishments report zero expenses, which cannot be correct. Lack of documentation on the Census of Services prevents us from finding out the reasons they report these values. Using definitions of profitability with or without expenses deducted produces similar results.

$$Revenue\ per\ Worker_{jt} = \frac{Revenue_{jt}}{\#Employees_{jt}},$$

$$Profits\ per\ Worker_{jt} = \frac{Profits_{jt}}{\#Employees_{jt}}.$$