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Abstract

Many developing countries have adopted the market approach for expanding the supply of child care, but little is known about the economic behavior of independent providers. This paper draws on uniquely rich administrative data on child care centers and their inputs from São Paulo to examine the role of local household income in shaping the entry and quality choices of private suppliers. It documents three main facts: (1) entry rates are considerably higher in high-income districts; (2) the quality of provision–as measured by teachers' schooling, group size and equipment–is highly heterogeneous across space and increases systematically with local household income; and (3) a considerable share of centers operates below recommended (but not regulated) quality standards, especially in low-income districts. These findings accord with a model in which heterogeneous providers optimally adjust the quality of care to the willingness to pay for quality of local consumers. Market-driven heterogeneity in the quality of provision across space is a key consideration for understanding the effect of regulations on the supply of child care.

JEL Classifications: D12, I21, I28, L21, L26, L51, O15

Keywords: Child care markets, Entry, Product quality, Minimum quality standards

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1 Introduction

The case for expanding early childhood care has become increasingly compelling in recent years. A growing body of evidence suggests that enrollment in preschool education has sizable positive impacts on subsequent educational, behavioral and economic outcomes (Currie and Thomas, 1995; Garces, Thomas and Currie, 2002; Berlinski et al. 2008, 2009). Drawing on evidence from a series of studies, Heckman (2006) concludes that early childhood care for disadvantaged children is more effective than interventions that come later in life, and advocates shifting educational spending to young disadvantaged children on both efficiency and equity grounds.

Although most countries have committed themselves to expanding child care provision, there seems to be little consensus on *how* to actually achieve this objective. While a number of OECD countries have moved towards universal provision within the public sector, many developing nations have implicitly or explicitly favored the market approach. According to UNESCO (2008), in 2005 the private sector accounted for a median value of 47 percent of total preschool enrollment in developing countries, versus only 8 percent in high-income nations. In a number of low and middle-income countries, such as Morocco, Indonesia and Uganda, the private sector was nearly the sole provider of preschool.[1,2]

Despite such a prominent role of independent providers in child care markets, little is known about their economic behavior. Do they primarily target high-income households leaving the poor behind? Does an unregulated market deliver appropriate levels of quality and safety? How might we expect regulations to influence the supply and quality of child care? This paper sheds new light on these questions by examining uniquely rich longitudinal census data on child care centers and their inputs from one of the world's largest urban centers: São Paulo, Brazil. This market is particularly well suited for this analysis, as private provision accounts for a large share of supply and remains largely unregulated.

To guide the empirical analysis, we adopt an industrial organization approach featuring optimizing behavior and heterogeneity on both sides of the market, drawing on Verhoogen (2008) and Urquiola and Verhoogen (2009). In the model, a continuum of heterogeneous providers decides on whether to operate a child care center in each of two geographically segmented markets. Child care markets are monopolistically competitive and differ in household income and hence on consumers' willingness to pay for child care quality. To operate a child care center in a given market, providers must incur a fixed and a marginal cost, each of which is potentially market-specific. Within each market, higher-productivity providers supply higher-quality services. For given productivity, cen-

[1] These data refer to preschool only. To the best of our knowledge, there are no internationally comparable data on the share of private enrollment in day care services.

[2] See also UNESCO (2004).

ters located in the higher-income market optimally employ higher-quality inputs in order to appeal to richer consumers. The effect of local household income on entry patterns is less clear-cut in the model due to the complex interplay between local household income, consumers' willingness to pay for child care quality and property rents.

The empirical results suggest that the market approach leads to considerable heterogeneity in the availability and quality of child care services across locations. Entry rates of independent providers are considerably higher in high-income city districts, despite higher property rents. This result is robust to a variety of specifications and to the inclusion of controls for the number (and size) of public providers. Furthermore, as predicted by the model, the quality of private child care–as as measured by teachers' schooling, group size and equipment–varies greatly across space and increases systematically with local household income. Indeed, in the absence of regulation a considerable share of child care centers operates below recommended (but not imposed) minimum standards of quality and safety, especially in low-income districts.

This paper contributes to a growing literature on the implications of choice and independent supply in education markets, including Manski (1992), Epple and Romano (1998), Nechyba (2003), Epple, Figlio and Romano (2004), Besley and Ghatak (2005), Urquiola (2005), Hsieh and Urquiola (2006), Rothstein (2006), Ferreyra (2007) and Epple and Romano (2008). While this literature has greatly improved our understanding on whether and how households sort between heterogeneous providers, comparatively little attention has been paid to how educational suppliers choose their location and quality. An important exception is recent work by Urquiola and Verhoogen (2009), who emphasize the role of household income and institutional constraints in determining primary schools' choices of class size. A key prediction, confirmed by Chilean data, is that class size varies endogenously with school productivity and household income, which will tend to confound attempts to estimate the effects of class size on educational outcomes. In addition to providing evidence that class size and other school inputs vary endogenously with household income in a different segment of the education market, a distinguishing feature of this paper is to emphasize the role of consumer income in shaping providers' entry choices across heterogeneous markets.

Our paper also relates to a relatively small literature on the location patterns of private primary schools in the U.S.. Using cross-sectional data for California, Downes and Greenstein (1996) relate the number of independent schools in narrowly defined geographic areas to the character of the population. Barrow (2006) provides related evidence for Illinois, using data for two points in time. Somewhat surprisingly, both studies find that the number of private schools in a given location is either unaffected or decreasing with local mean income. Our findings suggest that caution is needed in extrapolating such patterns to other contexts.

Finally, this paper complements recent evidence suggesting that the regulation of child care

inputs has heterogeneous effects on the supply and quality of care in rich and poor markets. Using panel data for the United States, Hotz and Xiao (2010) report two main findings: (1) more stringent regulations on establishment inputs reduce the number of child care centers, especially in lower-income markets; and (2) such regulations increase the quality of care, as measured by the share of establishments accredited by an independent authority, especially in higher-income locations. Hence they conclude that the costs of regulation are disproportionately felt by consumers in poorer markets. Importantly, however, the analysis of establishment quality is made difficult by the fact that providers' inputs cannot be directly observed and only a small proportion of centers are accredited. The current paper complements this strand of work by providing direct evidence on the role of local income in shaping providers' entry and quality choices in the absence of regulation. As discussed in more detail below, an important suggestion of our analysis is that caution is needed in inferring quality responses from changes in accreditation rates.

The remainder of the paper is structured as follows. Section 2 gives basic background information on the city of São Paulo and its child care market. Section 3 presents a theoretical framework that links entry and quality choices of private child care providers to local household income. Section 4 describes the data employed, before Section 5 provides evidence on the role of local income in shaping the entry and quality choices of private providers. Section 6 shows that a considerable proportion of centers in low income districts operate below recommended standards of quality and safety, and discusses how the imposition of regulations might be expected to impact on the supply and quality of child care. Section 7 concludes.

2 Background: São Paulo and its Child Care Market

With an estimated population of 10.9 million over 1,523 square kilometers, São Paulo is the largest municipality in Brazil and one of the world's largest cities. The municipality is composed of 96 administrative districts, which are characterized by great degree of socioeconomic inequality. Computations of the Human Development Index based on United Nations methodology reveal that, in the year 2000 a number of city districts score as high as Sweden and Canada, whereas others score as low as Mongolia and Azerbaijan (Perfeitura da Cidade de São Paulo, 2007). Despite having the highest income per capita in Brazil, estimates by Marques, Torres and Saraiva (2003) based on the 2000 population census suggest that about 11.1 percent of the population of the municipality resided in urban squatter neighborhoods.

Brazilian law stipulates that child care is composed of two different levels: day care for children aged between 0 and 3 years old, and preschool for those between 4 and 6. In São Paulo, as in the country as a whole, there are two types of child care providers:

(i) *Public* child care centers run either by the municipality or the state.

(ii) *Private* child care centers run independently.

Public child care centers are funded by the public budget at the municipal, state and federal levels. State legislation mandates that parents wishing to enroll their children in public child care must do so in a center that is located near their home. Enrollment is not subject to tuition fees, and public providers cannot reject children unless demand exceeds capacity. The majority of private child care providers are explicitly for-profit, and centers have full discretion over tuition fees (INEP, 2002). Most centers provide both levels of child care, although some offer preschool only (especially in the public sector). Unlike what is observed in most developed countries, the child care market remains highly unregulated. Although education authorities set minimum recommended standards on teacher qualifications and group size, centers were not bound by strict legal constraints on those variables.[3]

The supply of child care recorded a sizable expansion in recent years, a pattern that was common to many other low and middle income countries (UNESCO, 2008). Panel A of Figure 1 displays the expansion of private and public centers operating in the city during the 2000-2006 period. It shows that the number of private centers grew by 37 percent, while the number of their public counterparts rose by 29 percent. Although the number of private centers exceeds that of public centers by about 300 percent, the latter tend to be significantly larger. In fact, total enrollment in public child care accounted for about 60 percent of the total in this period. As shown in Panel B of Figure 1, enrollment increased by about 36 percent in both the private and the public sectors, clearly above the estimated increase in the population aged 0 to 6 (6.5 percent).

3 Theoretical Framework

This section presents a theoretical model that provides a framework for the empirical analysis. We draw heavily on Verhoogen (2008) and Urquiola and Verhoogen (2009), preserving the structure and analytical solutions of the former model, whilst adapting it to derive predictions about the entry and quality choices of private child care providers across heterogeneous districts within a city.

3.1 Household Preferences and Demand

Consider a city composed of two districts, Rich and Poor, indexed by $i = R, P$. In district i there is mass of C_i single-child households that resort to the services of a child care center. These households observe the quality of each of a continuum of child care centers in their own district

[3] At the time of writing, a legislation proposal on the introduction of group-size caps in child care had reached the Senate for final approval (PLS 396/08).

(indexed by ω) and select one of them.[4] Households are homogeneous within each district but differ across districts in a manner we will describe below. The representative household of district i has an indirect utility function given by:

$$V(\omega) = \theta_i q(\omega) - p(\omega) + \varepsilon \tag{1}$$

where q is child care quality, p is the tuition fee, and ε is a random term representing the utility of a particular household-center match. The parameter θ_i captures households' willingness to pay for child care quality, which increases with income.[5] Households residing in district R have a higher level of income than those in P and hence have higher willingness to pay for child care quality; that is: $\theta_R > \theta_P$.

Demand for child care in each district takes a multinomial logit formulation, wherein the random consumer-center-match term, ε, is iid across households with a type-I extreme-value distribution. Expected demand for each child care center can thus be written as:

$$x_i(\omega) = \frac{C_i \exp[\frac{1}{\mu}(\theta_i q(\omega) - p_i(\omega)]}{\int_{\Omega_i} \exp[\frac{1}{\mu}(\theta_i q(\omega) - p_i(\omega)] d\omega} \tag{2}$$

where μ gives the degree of differentiation between centers, and Ω_i is the set of child care centers available in district i. Child care providers are assumed to be risk neutral, implying that demand can be written without the expectation operator.

As noted by Verhoogen (2008) and Urquiola and Verhoogen (2009) this formulation of demand combines vertical differentiation with horizontal differentiation. The vertical component derives from differences in quality across centers, and implies that if tuition fees were equal across all centers in district i, higher-quality centers will be more likely chosen by parents. The horizontal component derives from the random consumer-center-match term, ε, and implies that if tuition fees are the same in every center in district i, enrollment in each center will occur with positive probability. In contrast to the vertical component, the horizontal attribute of each center has the property that some parents prefer it while others do not. This implies that a child care center with low quality and high price may nevertheless be chosen by parents, despite perfect information. In the present context, this attribute can be interpreted as different (but similarly effective) pedagogical strategies and/or different geographic locations within a given district.[6]

[4] We exclude the possibility that households residing in one district enroll their children in the other. This assumption is justified by empirical evidence suggesting that few parents will travel long distances to send their children to child care; see Chipty (1995) and Hofferth et al. (1991) for the United States and Paes de Barros et al. (2009) for Rio de Janeiro, Brazil.

[5] As noted by Verhoogen (2008) and Urquiola and Verhoogen (2009) this specification results from a direct utility function in which households have identical preferences and differ only in income.

[6] The horizontal component may also be interpreted as capturing parents' idiosyncratic perceptions of actual center

3.2 Child Care Production

In the city, there is a continuum of potential child care providers of mass 1. These individuals are heterogeneous in terms of managerial ability, captured by the exogenous parameter λ. Child care markets are geographically segmented, implying that to serve both markets a providers has to set up two independent centers, indexed by $i = R, P$. In equilibrium, potential providers optimally decide on whether to serve both districts, only one, or none.[7]

The provision of care to one child is assumed to require one teacher, one auxiliary worker, and physical capital.[8] The latter includes several equipment items such as adequate sanitation facilities, playground, computers, etc. Together with the ability of the entrepreneur, the quality of these inputs determine the quality of child care provision perceived by households:

$$q_i(k_i, e_i^t, e_i^a; \lambda) = \lambda (k_i)^{\alpha^k} (e_i^t)^{\alpha^t} (e_i^a)^{\alpha^a} \tag{3}$$

Here, k denotes the amount of capital used for child care purposes, while e^t and e^a are, respectively, the quality of the teacher and the auxiliary worker. One teacher cannot be replaced by many auxiliary workers, and the qualities of the teacher and auxiliary worker are complementary. To ensure an interior solution in the choice of quality, the model assumes $\alpha \equiv \alpha^k + \alpha^t + \alpha^a < 1$.

The cost of capital is represented by the exogenous parameter ρ. Turning to the labor market, child care entrepreneurs face upward-sloping quality-wage schedules for both teachers and auxiliary workers:

$$e_i^t = z^t (w_i^t - \underline{w}^t) \tag{4a}$$

$$e_i^a = z^a (w_i^a - \underline{w}^a) \tag{4b}$$

where w_i^t and w_i^a represent the wages for the teachers and auxiliary workers in a center located in district i, z^t and z^a are positive scalars, and $\underline{w}^t$ and $\underline{w}^a$ represent the average wages of teachers and auxiliary workers in the outside labor market.[9] As emphasized by Verhoogen (2008) these quality-

quality.

[7] An alternative approach would be to impose that each provider can operate only in one of the two districts. We have not pursued this path, as in the data it is common to observe centers with similar brand operating in different city districts. For the US, Hotz and Xiao (2010) are able to identify precisely child care centers affiliated with a chain, and report that a chain may have as many as 1,000 establishments. Notice, however, that all results would prevail if we were to assume that there exists a continuum of local providers in each district, and that each provider decides whether or not to enter the corresponding district.

[8] Notice that all these inputs exist in the data. For simplicity, we abstract from choices of group size in modelling establishment quality. This is the primary focus of Urquiola and Verhogen (2009). Empirically, we would expect group size to vary with household income, in line with other input choices.

[9] We will assume throughout that $\underline{w}^t$ and $\underline{w}^a$ are exogenous. This is justified in our context given that the child care market is small relative to the local labor market as a whole.

wage schedules are consistent with a variety of underlying mechanisms. In the present context, a natural interpretation is similar in spirit to Kremer (1993): the quality of teachers and auxiliary workers increases with their level of schooling (which is heterogeneous within the two occupations), and to attract higher-skill professionals in each of these occupations child care centers need to pay higher wages. In addition, centers located in richer districts may adopt efficiency wage policies to induce greater worker effort, and thereby provide higher quality services to higher-income consumers.

To operate a child care center in district i, entrepreneurs have to incur a fixed cost F_i. Realistically, we assume that $F_R > F_P$ due to higher property rents in the richer district. For a given quality level, horizontal differentiation is costless and each center is constrained to offer one variety. As a result, every preschool center differentiates and has a monopoly in the market for its variety ω.

3.3 Market Equilibrium

Child care entrepreneurs set the optimal tuition fee, the teacher and auxiliary worker's wages, and capital intensity for each district separately. In district i, each center thinks of itself as small relative to the market as a whole. Hence, private providers treat the denominator in (2), which is determined in market equilibrium, parametrically when making their own decisions. The center-specific quality is governed by input choices, which together with tuition fees determine enrollment. Formally, equilibrium outcomes can be expressed as:

$$q_i^*(\lambda) = (\eta\lambda\theta_i^{\alpha})^{1/(1-\alpha)} \tag{5a}$$

$$w_i^{t*}(\lambda) = \underline{w}^t + \alpha^t\theta_i q_i^*(\lambda) \tag{5b}$$

$$w_i^{a*}(\lambda) = \underline{w}^a + \alpha^a\theta_i q_i^*(\lambda) \tag{5c}$$

$$k_i^*(\lambda) = \frac{\alpha^k}{\rho}\theta_i q_i^*(\lambda) \tag{5d}$$

$$p_i^*(\lambda) = \mu + \underline{w}^t + \underline{w}^a + \alpha\theta_i q_i^*(\lambda) \tag{5e}$$

where $\eta \equiv (z^t\alpha^t)^{\alpha^t}(z^a\alpha^a)^{\alpha^a}(\frac{\alpha^k}{\rho})^{\alpha^k}$ and μ a mark-up.

3.3.1 Quality, Inputs and Tuition

The model yields intuitive predictions about the quality choices of child care providers within and across districts. First, within each district, higher-productivity providers run higher-quality centers, pay higher wages to teachers and auxiliary workers, are more capital intensive, and charge higher tuition fees. Second, since $\theta_R > \theta_P$, providers running child care centers in the two districts will

choose to provide higher quality and charge higher tuition fees in the richer district. To provide higher quality care, they employ more qualified teachers and auxiliary workers, pay higher wages to workers in each of these categories, and are more capital intensive. Third, since each center is small relative to the market as a whole, quality choices of individual providers are independent of both market size and the number of centers operating in that market.

3.3.2 Enrollment and Entry

The model is also useful to identify specific channels whereby district attributes may impact on entry decisions. To this end it is convenient to write down the expression for equilibrium enrollment of a given child care center:

$$x_i^*(\lambda) = \frac{C_i \exp\{B_i^*(\lambda)\}}{\int_{\Omega_i} \exp\{B_i^*(\lambda)\} d\lambda} \tag{6}$$

where $B_i^*(\lambda) \equiv \frac{1}{\mu}[(1-\alpha)(\eta\theta_i\lambda)^{\frac{1}{1-\alpha}} - (\mu + \underline{w}^t + \underline{w}^a)]$ is increasing in λ and θ_i.[10]

Profit of a given center is thus given by $\pi_i^*(\lambda) = \mu x_i^*(\lambda) - F_i$ and is also increasing in λ. Hence, in equilibrium there is a single ability cutoff determining entry in district i. Specifically, entrepreneurs with managerial ability above $\lambda_i^{\min}$ will enter the market and have positive profits, whereas less able entrepreneurs will choose not to enter it. The equilibrium level of $\lambda_i^{\min}$ is defined implicitly by the condition that the marginal center in district i must earn zero profits:

$$\pi_i^*(\lambda_i^{\min}) = \frac{\mu C_i \exp\{B_i^*(\lambda_i^{\min})\}}{\int_{\lambda_i^{\min}}^1 \exp\{B_i^*(\lambda)\} d\lambda} - F_i \tag{7}$$

From (7) it can be verified that $\lambda_i^{\min}$ decreases (and thus the number of centers increases) with C_i, as would be expected. Conditional on C_i, however, the effect of local income per capita on the number of active centers is generally ambiguous, as local income increases both θ_i and F_i. Further, under the assumption that the consumer market clears (i.e., that private enrollment equals demand for private child care services), greater entry in a given district increases the denominator in (6), thereby lowering equilibrium enrollment of each center.[11]

3.3.3 Summary

Figure 2 summarizes the main implications of the model for the effect of local income per capita on entry and quality patterns. We consider two alternative scenarios: panel A assumes higher equilibrium entry in the richer district, while panel B assumes the converse. In both these cases,

[10] For further details see Verhoogen (2004, pp. 14-15).

[11] The assumption that the consumer market clears is not made for its realism, but rather to emphasize that in a long-term equilibrium enrollment of each center varies endogenously with the number of active centers in each location.

the upper quality-ability schedule refers to establishments located in the richer district, while the lower schedule concerns establishments located in the poorer district.[12] The solid segments of each schedule represent the quality of active establishments in each district as a function of entrepreneurial ability. The (unweighted) average of establishment quality in each district is represented by $\overline{q}_R$ and $\overline{q}_P$.

It is worth noting that, due to heterogeneity of entrepreneurial ability, greater entry in a given district leads *ceteris paribus* to lower average establishment quality in that district. Average quality in the richer district is consequently lower in Panel A than in Panel B. From Panel A, it is also clear that, while greater entry in the richer district dampens the first- order positive effect of household income on average establishment quality, it will not eliminate it as long as quality-ability schedules are not too steep or the distance between $\lambda_R^{\min}$ and $\lambda_P^{\min}$ is not too large.

4 Data

We use data on São Paulo's child care centers, their inputs and average wages, and district attributes. Data on child care centers and their inputs come from the School Census or *Censo Escolar* (CE) for the years 2000 to 2006. *Censo Escolar* is a compulsory yearly administrative census conducted by the Brazilian Ministry of Education, in conjunction with the state-level education departments. Befitting its name, this data set gathers information on all public and private educational centers in Brazil.[13] In each year, it comprises data on enrollment, number of groups, number of teachers per grade, as well as on the highest schooling level they have achieved. In addition, it collects information on the infrastructure and equipment of each center, such whether it has adequate sanitation for preschool, a playground, a refrigerator, and the number of computers. An important feature of these data is the high reliability of the information. Indeed, inspections are carried out every year on a random sample of centers to ensure that the information is accurately reported.

Data on average wages of child care teachers are available for 105 private centers in 2006/2007. The source of this information is a ranking of average wages in private schools constructed by the teachers' labor union of São Paulo, which has been circulated by the press.[14] Interestingly, this ranking shows that the distribution of average center wages is very wide: the average wage at the

[12] This representation assumes $C_R = C_P$, as we seek to illustrate the effect of household income on the number and quality of child care establishments, conditional on the number of children of child care age.

[13] Although microdata from *Censo Escolar* are available from 1996, until 1999 the census did not include comprehensive information on day care services. Begining in 1997, the Ministry of Education carried out an extensive effort to include all day care establishments in *Censo Escolar*, implying that from 2000 this data set can be safely used as a census of child care establishments (INEP, 2002).

[14] "Salários nas escolas particulares de São Paulo variam ate 624% " [Wages in São Paulo's private schools vary 624%], Folha Online, 03/10/2007.

top 10 centers is about 600 percent higher than at the bottom 10 centers. Using information on the name and precise address of each center, we were able to merge these data for 85 centers of the 2006 school census, which are located in 44 city districts.[15]

Socioeconomic and demographic information on the 96 administrative districts of the city come from two sources. Yearly estimates for the population aged up to 6 years old in each city district come from the Foundation for Data Analysis of the State of São Paulo (SEADE). Also at the district level, we use data from the 2007 Municipal Atlas on income per capita and the average years of education of the population aged 25 or older in the years 1991 and 2000. This publication of the local government gathers several socioeconomic and demographic indicators for each city district, and is constructed from Brazil's decennial population census of 1991 and 2000.

Summary Statistics

To make the 96 administrative districts of the city more transparent, Figures 3 and 4 plot the relationship between various sociodemographic attributes in the year 2000. Figure 3 illustrates the great degree of spatial inequality that prevails in the city, both with regard to average income and adults' schooling. In addition, it reveals that these two variables are highly colinear, i.e., that higher-income districts also display greater levels of adult education.[16] Figure 4 in turn shows that lower-income city districts tend to have a larger number of children up to 6 years of age.

While center-level data refer to the 2000-2006 period, data on income per capita in each district are available only for the years 1991 and 2000. To get a sense of how this variable evolves over time, Figure A.1 in the Appendix displays the relationship between its values in 1991 and 2000. It is evident that the relative positioning of city districts in terms of income per capita has remained fairly stable over time, suggesting that the use of 2000 variables to characterize the socioeconomic attributes of the city over the period of analysis will not likely entail significant measurement error.

Table 1 reports detailed summary statistics on the panel data employed in the econometric analysis. Several points are worthy noting. First, the number of private child care centers exhibits significant heterogeneity across districts. Second, only a minority of day care and preschool teachers in private centers have attended higher education; preschool teachers in the private sector display on average significantly lower levels of schooling than in the public sector, while the converse happens with day care teachers. Third, private centers tend to run smaller group sizes than their public counterparts. Finally, the quality of private provision, as measured by group size, teachers' schooling and equipment, is highly heterogeneous. Indeed, both teachers' schooling and group size tend to be more heterogeneous in the private than in the public sector.

[15] This imperfect correspondence might reflect the fact that the ranking uses data from 2006/2007, whereas *Censo Escolar* was sent to educational establishments in March 2006.

[16] A log-log OLS regression of mean income on average years of education of the population over 25 years yields a coefficient of 3.02, a standard error of 0.055, an R-squared of 0.97 and an F-statistic of 3064.5.

5 Empirical Evidence

5.1 Entry Choices across Districts

We start by examining the role of local household income in shaping entry rates of independent providers. To this end we start by estimating the following count data specification:

$$E(\textit{private centers}_{jt}\,|\mathbf{X}_{jt}+\nu_t)=\mu_{jt}=\exp(\mathbf{X}_{jt}\beta+\nu_t) \tag{8}$$

where $\mathbf{X}_{jt}$ is a vector of attributes of district j in year t and ν_t are year fixed-effects.

We obtain estimates of the parameters in (8) via Poisson estimation and report the results in Table 2. The estimates presented in Panel A suggest that the number of private child care centers is significantly higher in larger and richer city districts. This pattern holds in the cross-section for the beginning, middle and end of the sample period, as well as in pooled data; columns (1) to (4). The estimated effect of household income on private supply is sizable: in the specification presented in the top panel of column (4), a 10 percent increase in income per capita is associated with an 8 percent increase in the number of private centers.

In column (5) we assess the extent to which the results are sensitive to the use of data for the year 2000 to characterize city districts with respect to income per capita. To this end we linearly extrapolate this variable using 1991 and 2000 values.[17] The results remain virtually unchanged. In columns (6) to (10) we introduce controls for the number of public centers in each district. Although the model presented in the previous section abstracts from public child care centers, empirically one might expect the location choices of private providers to be influenced by their presence. It turns out that the results remain qualitatively unaltered when the number of public centers in each district is included among the regressors. As a further robustness check, Panel B of Table 2 reports analogous regressions using the average education of the population over 25 years old in each district as an alternative measure. This specification yields similar results, as would be expected given the very high degree of colinearity between mean income and average education reported in the previous section.

In Table 3 we examine how entry of private centers is influenced by predetermined district attributes. As is standard in the literature, we adopt Poisson estimation on a specification similar to (8), but using birth counts per district-year as the dependent variable (Guimarães, Figueiredo and Woodward, 2003; Arzaghi and Henderson, 2008). The results reported in column (1) show that the above findings remain qualitatively unaltered when birth counts are used instead. Entry of private centers is significantly higher in richer city districts. In columns (2) to (4) we examine the extent to

[17]The extrapolated data are then deflated using the CPI for São Paulo from *Fundação Instituto de Pesquisas Econômicas*.

which the results are sensitive to the use of 2000 figures for district attributes: column (2) presents estimates based on linearly extrapolated district attributes, while column (3) in turn presents the results based on 1991 figures. In both cases, the results remain very similar to those reported in column (1).[18] Finally, in columns (4) and (5) we assess the extent to which entry decisions might be influenced by the number and size of existing public centers. Consistent with the results presented previously, the estimates provide little evidence that public child care provision influences the location choices of private providers. Overall, thus, the results suggest that the market approach leads to greater availability of child care centers in higher-income markets, despite the higher costs of property.

A potential concern with this interpretation is that the differential patterns of entry across districts might stem from lower intrinsic motivation of poorer households to enroll their children in child care services, even at zero tuition. This might happen, for instance, if mothers in poorer districts were less willing to participate in the labor market. Two related pieces of evidence argue against this hypothesis, however. First, the estimates reported in Table 4 suggest that, conditional on the number of children of child care age, newly-created public establishments tended to open primarily in lower-income city districts. Second, estimates of the local government point to sizable waiting lists for enrollment in public child care establishments in lower-income city districts.[19]

5.2 Quality Choices across Districts

The theoretical framework we adopt suggests that private providers have an incentive to adjust the quality of provision to the attributes of the local population, notably their willingness to pay for quality. To investigate this hypothesis empirically we estimate regressions at the center level, relating several proxies of center quality to district attributes. Specifically, we adopt the following specification:

$$\textit{quality}_{ijt} = \mathbf{X}_{jt}\beta + \nu_t + \varepsilon_{jit} \tag{9}$$

where $\textit{quality}_{ijt}$ is an indicator of quality of center i located in district j in year t, where $\mathbf{X}_{jt}$ and ν_t have the meaning defined above.[20]

[18] All results in the paper are insensitive to the use district attributes for 1991, 2000 or extrapolating to the period 2000-2006. Hence in the remainder of the paper we will report only the results obtained with figures for the year 2000.

[19] In June 2008, São Paulo's local government announced that 146,834 children were in waiting list for child care services in the city, the majority of whom were in poor city districts. This amounts to 36 percent of total enrollment in public child care establishments at the time. See, e.g., "Em São Paulo, faltam 146, 834 vagas na educação infantil, segundo a perfeitura. [In São Paulo, there are 146,834 missing places in child care, according to the local government]" UOL Portal Aprendiz, 06/16/2008.

[20] In line with the theoretical framework presented above, we will use information on observable inputs to measure the quality of child care provision. Admittedly, there are other important dimensions of quality that available data do not permit us to examine, notably the nature of adult-child interaction.

5.2.1 Teacher Schooling and Wages

We begin by analyzing how district attributes influence average teacher qualifications in private child care centers. Since *Censo Escolar* provides information detailed by grade, we estimate separate regressions for each of the two existing levels of child care provision in Brazil: day care and preschool. The former are reported in Panel A of Table 5, and the latter in Panel B.[21] In line with the predictions of the model, the estimates reported in column (1) of Table 5 suggest that centers located in higher-income, higher-education city districts tend to employ day care teachers with higher levels of schooling than their counterparts in poorer districts. Column (2) shows that this estimate remains virtually unaltered when controls for the size of the market are included. To see whether quality differentials across locations are influenced by the age of the child care centers, we run separate regressions for private centers aged two years or less, and those older than two years.[22] It turns out that the coefficients are very similar across age groups, suggesting that possible heterogeneity of center age across districts is not driving the qualitative results. In Panel B of Table 5, we run analogous regressions for preschool teachers in private centers. The results are very similar to those reported in Panel A, as we would expect.

The theoretical framework presented in the previous section further predicts that in order to attract higher quality teachers private centers located in higher-income city districts optimally pay higher wages. To investigate this proposition empirically we use data on average teacher wages for 85 child care centers in 2006/2007. Table 6 reports the results. Although the small size of this sample recommends caution in interpreting these estimates, they do suggest that teacher wages are significantly higher in private centers located in richer city districts. In Panel B, we further examine whether average wages at the center level are significantly associated with the proportion of teachers that have attended or concluded higher education studies. In both cases, the results point indeed to a positive correlation, although the parameter of interest is more precisely estimated in column (2). The empirical results are therefore in line with the theoretical prediction that private centers located in richer districts pay higher wages to attract more qualified teachers, and thereby provide higher quality child care services to appeal to richer consumers.[23]

[21] We have not separately examined entry decisions for day care and preschool because most private establishments provide both levels of child care.

[22] The data used in this exercise are restricted to the 2002-2006 period, so that each establishment can be precisely assigned to each age category.

[23] The model predicts that a similar pattern would prevail for auxiliary workers. Unfortunately, the data do not allow us to investigate this hypothesis. Although the number of auxiliary workers employed in each establishment is reported, we do not possess information on their qualifications or wages.

5.2.2 Group Size

We proceed by examining whether, in addition to teacher schooling, there are systematic differences in mean group size across city districts. While the theoretical framework presented above does not model explicitly center choices of group size, intuitively we would expect this important indicator of quality to be influenced as well by consumers' willingness to pay for quality. In fact, in the model of Urquiola and Verhoogen (2009) class size is the sole dimension of quality that private primary schools are assumed to adjust in order to appeal to higher-income consumers. Due to the absence of strict legal restrictions on group size, São Paulo's child care market provides an interesting setting to examine this question.

As before, we estimate separate regressions for day care and preschool services. The estimates reported in Table 7 point indeed to the existence of systematic differences in group size across city districts: private centers located in higher-income city districts run significantly smaller group sizes than their counterparts in poorer districts. The estimates suggest that doubling a district's income per capita reduces the average group size in day care by about 20 percent; in analogous regressions for preschool, the corresponding estimates are 12 percent. The extent of heterogeneity is therefore sizable, taking into account that the distribution of mean income across locations is very wide (Figure 2).

These results complement and extend those of Urquiola and Verhoogen (2009) in two important ways. First, they show that a key insight of their work–that group size varies endogenously with household income–is not specific to private primary schools nor to the more regulated Chilean market. Second, they suggest that the heterogeneity of group size in child care has a strong geographic dimension, even within a single municipality.

5.2.3 Equipment

The model also predicts that in order to provide higher quality services private centers located in higher-income districts will choose to employ more sophisticated equipment. We investigate this hypothesis empirically using information on several items at the center level provided by Censo Escolar. Table 8 reports the results.[24] Consistent with the model, we find that private centers located in higher-income city districts tend to employ significantly more computers per child than their counterparts in lower-income districts, and are also more likely to have adequate sanitation for preschool and a refrigerator.[25]

[24] Data on equipment are available only at the establishment level. To improve comparability across establishments, we restrict the analysis to establishments providing both day care and preschool.

[25] Some caution is needed in interpreting the results on computers per child, as we have no information on the extent to which they are used for pedagogical or administrative purposes.

5.2.4 Quality in Public Centers

As we noted above, the positive association between teacher qualifications, wages and local income per capita is consistent with the mechanisms emphasized by the theoretical model presented in Section 3. A possible concern, however, is that this pattern might be explained by alternative mechanisms, notably heterogeneity and segmentation in the teacher labor market. To investigate this alternative hypothesis further, we examine the extent to which a similar pattern can be identified for public establishments, which are not motivated by profit and recruit from the same labor market. Table 9 reports the results. For day care, the estimated coefficients are insignificant and close to zero. For preschool, they are positive and significant, but always of considerably smaller magnitude than those reported in Table 5. Overall, therefore, these results suggest that heterogeneity in the inputs market across districts is not the main driver of our results.

For completeness, we also examine the extent to which quality differentials across districts can also be identified for other center inputs in the public sector. Tables 10 and 11 report the results. The coefficients of interest tend to be less precisely estimated than in equivalent regressions for the private sector, and suggest that if any positive relation between establishment quality and household income exists, it is considerably smaller in magnitude. Taken together, these results suggest that the quality of private centers is considerably more heterogeneous than that of their public counterparts, as would be expected if quality differentials in the private sector were mainly driven by firms' profit-maximizing behavior and heterogeneity in consumers' willingness to pay for quality across locations.

6 Minimum Quality Standards

Should child care markets be regulated? In recent years this question has been subject to great interest and debate, but controversy remains. Advocates of regulation have emphasized the importance of ensuring adequate standards of quality and safety, so as to preclude negative public externalities arising from low-quality services and address imperfect parental ability to assess or monitor the quality of care (e.g., Walker, 1991; Mocan, 2007). It has also been noted, however, that the regulation of child care inputs may have unintended impacts on the supply of market-based services. Most empirical studies in this vein focus on the U.S. market and exploit cross-sectional variation in regulations between states to identify their effects. Against a background of important data limitations, the general conclusion seems to be that more stringent regulations reduce the availability and utilization of child care centers (Gormley, 1991; Lowenberg and Tinnin, 1992; Blau 2003, 2007).

In influential work, Hotz and Xiao (2010) examine U.S. panel data on state regulations and

child care centers, and conclude that the imposition of more stringent minimum standards generates winners and losers, the latter of whom tend to be concentrated in low-income areas. In particular, they provide evidence that the regulation of child care inputs: (1) reduces the number of child care centers, especially in low-income markets; and (2) increases the quality of provision, as as measured by the share of centers accredited by an independent authority, especially in high-income areas. Importantly, however, the analysis of establishment quality is made difficult by the fact that input quality cannot be directly observed, and only a small proportion of very high-quality centers are accredited.

This section provides complementary evidence to this literature. We begin by examining whether an unregulated market leads to adequate levels of quality and safety. Building on this evidence, we then use the theoretical model of Section 3 to discuss specific channels whereby regulations might be expected to impact on the availability and quality of child care. In doing so, we draw implications for empirical work seeking to estimate the impact of regulations on the supply and quality of care.

6.1 Does an Unregulated Market Deliver Adequate Quality?

We begin by examining the proportion of centers that operate below adequate quality standards on child care inputs. To this end we use the minimum standards recommended (but not imposed) by the Brazilian authorities on group size and teacher qualifications. For comparison, we also consider regulations effectively applied in different U.S .states. For each input, we order U.S. states by degree of regulatory stringency in 1996 and recover the minimum quality standard in the 10th, 50th and 90th percentile of this distribution.[26] Using cross-sectional data for 2006, we then compute the proportion of "non-compliant" centers in each of three groups of districts, defined on the basis of their income per capita in the year 2000.

Table 9 reports the results. They suggest that a significant proportion of child care centers operates below recommended (but not imposed) quality standards. For instance, the share of day care centers operating below the minimum standards recommended by Brazilian authorities on group size and teacher qualifications was 12.4 percent and 35.4 percent, respectively. In general, the share of centers operating below adequate standards of quality is especially high for day care services, though the number of preschool services operating below the recommended threshold is non-negligible.[27] Furthermore, there is clear evidence that the proportion of centers that do not satisfy adequate standards is particularly high in poorer city districts, as one would expect in the

[26] We use data for 1996, as this is the latest year for which we have consistent data on these regulations. U.S. regulations are defined by age, and so we are able to compute averages for day care and preschool services.

[27] A possible explanation for these differences between day care and preschool is that the number of public child care centers providing day care is relatively small compared to preschool. Greater availability of public centers might deter low-income households from resorting to low-quality private child care services.

light of the evidence reported in the previous section. For example, 51.5 percent of day care services in low-income districts operate below the minimum standards on teacher qualifications in day care recommended by Brazilian authorities, clearly above the corresponding share in high-income districts (21.4 percent). Similar patterns are observed when using U.S. effective regulations.

6.2 Regulations, Entry and Quality

How might we expect the imposition and enforcement of regulations to affect the supply and quality of child care? The model presented in Section 3 and the empirical findings we have documented are consistent with the estimates reported by Hotz and Xiao (2010). In the context of the equilibrium patterns represented in Figure 4, let us assume that a minimum quality standard q_m is imposed, which applies to every child care center in the city. In this situation, a city-wide minimum quality standard is more likely to be binding for centers located in district P than in R. The number of centers that not longer find it profitable to operate in market due to the introduction of q_m is therefore larger in district P than in R. Assume now that q_a denotes the minimum quality that centers must satisfy in order to be accredited by an independent authority. If q_a is sufficiently high, only a small fraction of high-quality centers located in the high-income district are able to obtain accreditation.[28] By deterring entry (or inducing exit) of less able providers in district R, the introduction of q_m increases the share of accredited centers in that market.

However, from Figure 4 it is also clear that by deterring entry of low-productivity, low-quality providers, the imposition of regulations would likely lead to improvements in the average quality of care, especially in low-income districts. This process need not translate into higher accreditation rates, however, as the quality supplied by the most productive providers in low income districts is still below the threshold required for accreditation. Moreover, this framework suggests that caution is needed in establishing a direct link between entry patterns and enrollment: in the long term, reduced entry of low-productivity providers due to regulations would likely enable higher-productivity, higher-quality suppliers to expand (cf. eq. (6)). Although this expansion may plausibly occur at the expense of lower quality in each center (e.g., due to larger group sizes), the *average* quality of supply might nevertheless increase as a result of the reallocation of households to higher-productivity providers. Hence the ability of directly observing adjustments in input quality and enrollment following the imposition of regulations plays (should play) a key role in future empirical work seeking to estimate their short and long-run impacts on the utilization and quality of child care.

[28] Notice that Hotz and Xiao (2010) report that only a small fraction of child care centers are accredited (9.7 percent of the total in 1997), reflecting the fact that only very high quality establishments are able to comply with the standards of the National Association of Education for Young Children.

7 Concluding Remarks

In recent years many countries have turned to the market approach for expanding the supply of child care, but little is known about the implications of this policy option for the availability and quality of care. This paper has contributed to filling this gap in the literature by examining the role of local household income in shaping the entry and quality choices of private child care providers. To this end we have exploited uniquely rich administrative data on child care centers and their inputs from one of the world's largest urban centers: São Paulo, Brazil.

The results reveal that the market approach leads to considerable heterogeneity in the availability and quality of child care services across locations. Entry rates of independent providers are considerably higher in higher-income city districts. In addition, the quality of private child care–as measured by teachers' schooling, group size and equipment–varies greatly across space and increases systematically with local household income. Indeed, in the absence of regulation a considerable proportion of centers operates below recommended standards of quality and safety, especially in low-income city districts. We have used a theoretical model with optimizing behavior and heterogeneity on both sides of the market as the basic framework to understand these relationships. The model accords well with the facts and emphasizes important channels whereby regulations might affect the supply and quality of care in child care markets.

From a public policy perspective, our overall reading of the results is that a combination of regulations and publicly funded provision directed towards low-income areas plays (should play) an important role in ensuring more equitable access to developmentally-enriching child care services.

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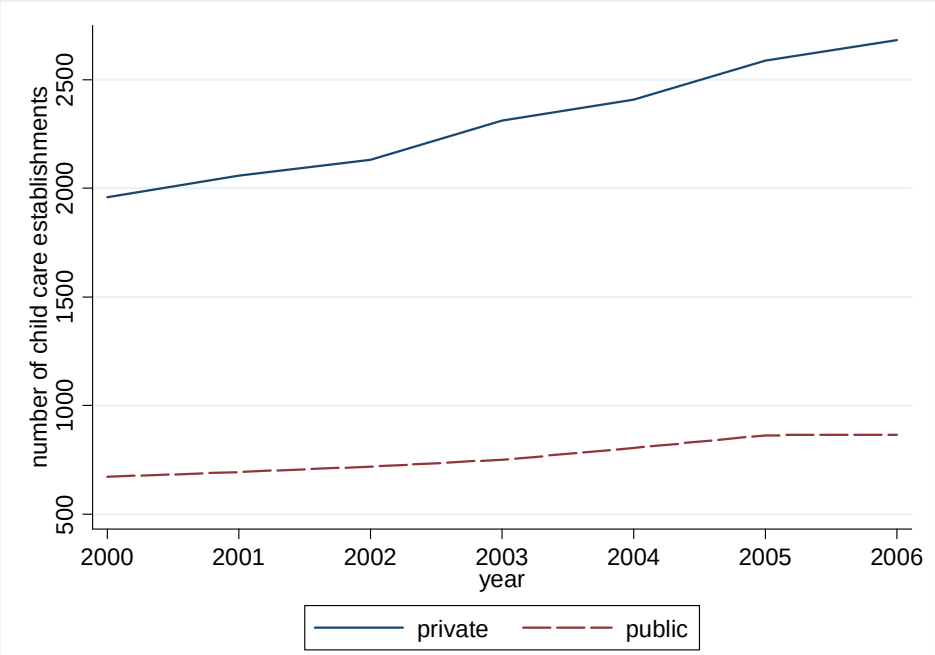
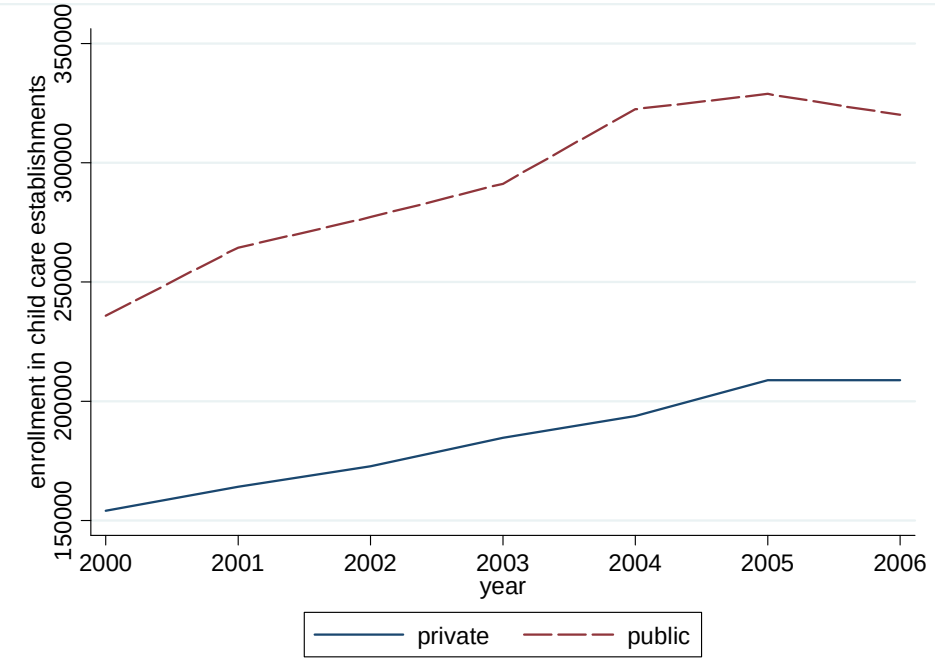
Figure 1. São Paulo's Child Care Market, 2000-2006

Panel A: Number of Child Care Centers



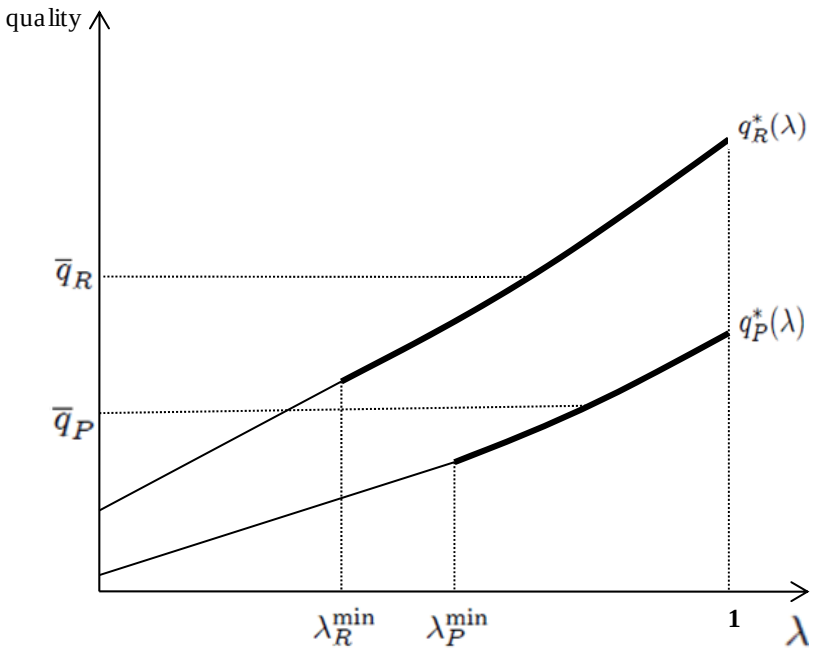
Panel B: Enrollment in Child Care Centers



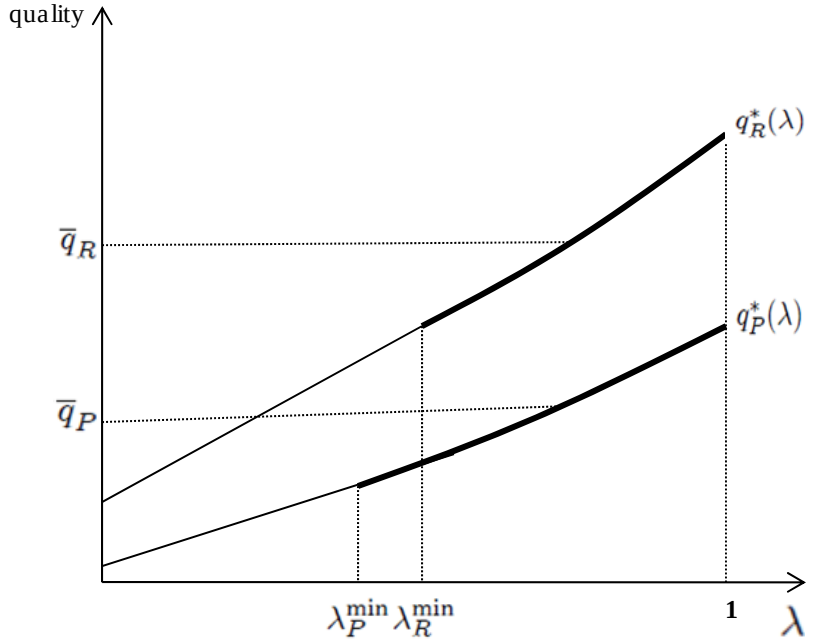
Source: Censo Escolar.

Figure 2. Entry and Quality of Private Centers

Panel A

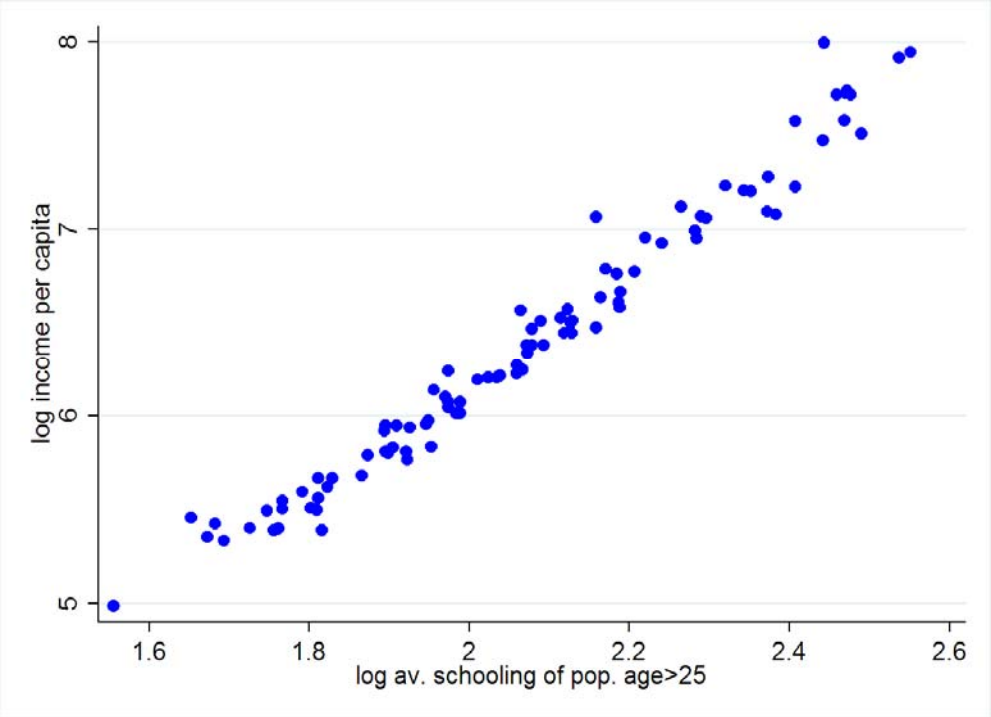


Panel B



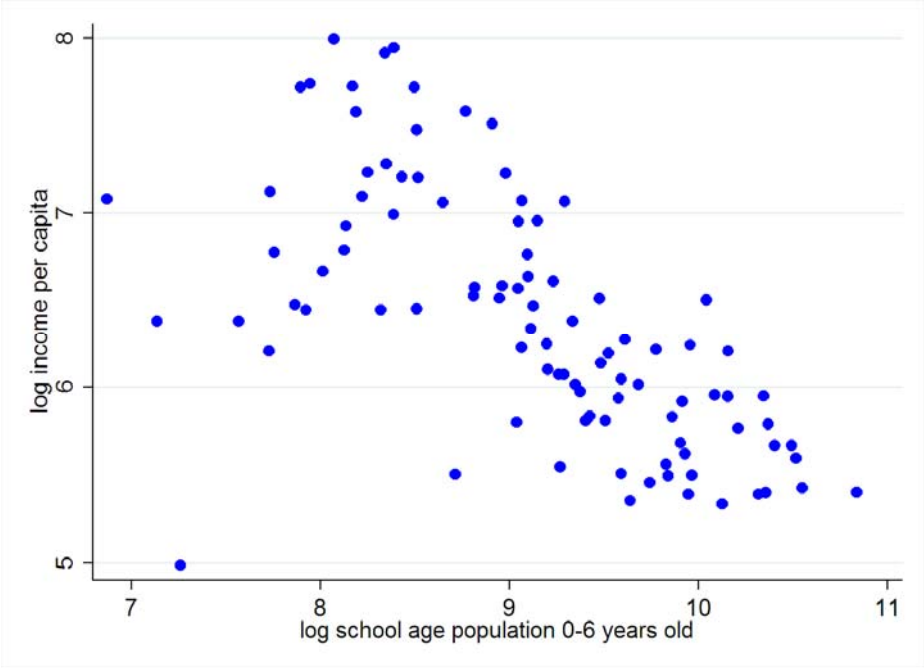
Source: Authors' compilation

Figure 3. Income Per Capita and Adult Education in the 96 Districts, 2000



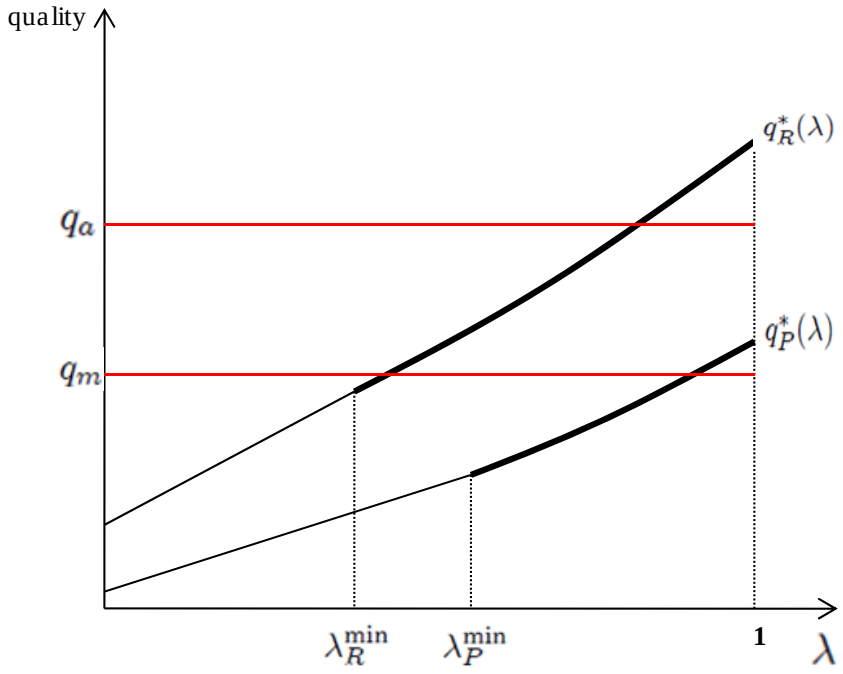
Source: Perfeitura da Cidade de São Paulo (2007).

Figure 4. Income Per Capita and Number of Children Aged 0 to 6 in the 96 Districts, 2000



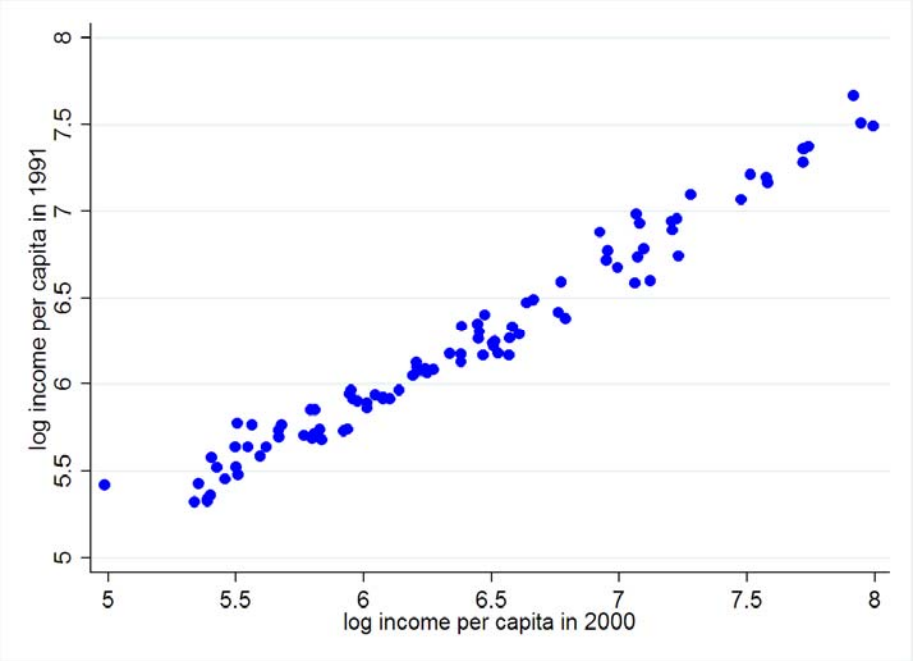
Source: SEADE.

Figure 5.Minimum Quality Standards



Source: Authors' compilation.

Figure A.1. Within-District Evolution of Income Per Capita, 1991-2000



Source: Perfeitura da Cidade de São Paulo (2007).

Table 1. Summary Statistics, 2000-2006

	Mean	St. Dev.	N
City district variables			
Income per capita, 1991 (reais per month)	610.86	417.28	96
Income per capita, 2000 (reais per month)	783.11	642.79	96
Real income per capita, 2000-2006 extrapolated (2000 prices)	679.81	584.99	96
Av. years of schooling pop. > 25 years old, 1991	6.81	1.93	96
Av. years of schooling pop. > 25 years old, 2000	8.16	1.96	96
Av. years of schooling pop. > 25 years old, 2000-2006 extrapolated	8.60	2.00	672
Population aged between 0 and 6	13086.93	10238.19	672
Number of private centers	24.01	15.40	672
Number of public centers	7.98	6.57	672
Private enrolment	1914.28	1082.38	672
Public enrolment	3036.03	2585.90	672
Private center variables			
% of teachers that have some higher education (day care 0-3)	0.19	0.35	11029
% of teachers that have some higher education (preschool 4-6)	0.39	0.40	13146
Av. teacher wage (reais per month)	1695.36	996.12	85
Av. group size (day care 0-3)	11.89	7.20	11029
Av. group size (preschool 4-6)	12.14	5.94	13146
Has playground? (Yes=1)	0.93	0.25	8127
Has adequate sanitation for preschool? (Yes=1)	0.91	0.28	8127
Has fridge? (Yes=1)	0.95	0.22	8127
Computers per child	0.11	0.25	8127
Public center variables			
% of teachers that have attended higher education (day care 0-3)	0.12	0.25	2287
% of teachers that have attended higher education (preschool 4-6)	0.63	0.31	4039
Average group size (day care 0-3)	15.26	5.29	2287
Average group size (preschool 4-6)	31.33	6.89	4039
Has playground? (Yes=1)	0.83	0.38	963
Has adequate sanitation for preschool? (Yes=1)	0.93	0.25	963
Has fridge? (Yes=1)	0.97	0.17	963
Computers per child	0.01	0.02	963

Source: Authors' computations based on data described in Section 4.
Notes: Statistics for equipment refer to centers that have both day care and preschool services.

Table 2. Number of Private Child Care Centers

Dependent variable: Number of private centers	2000	2003	2006	2000-2006	2000-2006 extrapol.	2000	2003	2006	2000-2006	2000-2006 extrapol.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A										
Log population aged between 0 and 6	0.668***	0.734***	0.753***	0.715***	0.720***	0.627***	0.688***	0.709***	0.655***	0.656***
	(0.088)	(0.087)	(0.079)	(0.081)	(0.080)	(0.130)	(0.125)	(0.119)	(0.115)	(0.113)
Log income per capita	0.915***	0.806***	0.678***	0.784***	0.749***	0.928***	0.821***	0.696***	0.806***	0.772***
	(0.096)	(0.097)	(0.091)	(0.092)	(0.085)	(0.095)	(0.095)	(0.091)	(0.091)	(0.085)
Number of public centers						0.008	0.008	0.007	0.011	0.012
						(0.017)	(0.015)	(0.012)	(0.013)	(0.013)
Year dummies	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Log-pseudolikelihood	-462.25	-491.744	-524.142	-3494.469	-3484.68	-461.577	-490.672	-523.044	-3481.789	-3469.699
N	96	96	96	672	672	96	96	96	672	672
Panel B										
Log population aged between 0 and 6	0.715***	0.791***	0.814***	0.770***	0.773***	0.690***	0.767***	0.786***	0.726***	0.734***
	(0.078)	(0.077)	(0.068)	(0.071)	(0.071)	(0.110)	(0.112)	(0.105)	(0.100)	(0.102)
Log average years of schooling pop. > 25 years old	3.050***	2.719***	2.321***	2.642***	2.778***	3.072***	2.739***	2.351***	2.686***	2.816***
	(0.249)	(0.255)	(0.236)	(0.239)	(0.253)	(0.255)	(0.258)	(0.246)	(0.246)	(0.257)
Number of public centers						0.005	0.004	0.004	0.007	0.006
						(0.016)	(0.014)	(0.012)	(0.013)	(0.013)
Year dummies	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Log-pseudolikelihood	-442.113	-467.759	-499.155	-3337.114	-3314.022	-441.883	-467.487	-498.742	-3330.659	-3308.964
N	96	96	96	672	672	96	96	96	672	672

Source: Authors' computations based on data described in Section 4.

Notes: The estimation method is Poisson. The unit of observation is district-year. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district. Column titles present the period of analysis for each specification. Results in columns (5) and (10) are based on district attributes for 2000-2006, linearly extrapolated from 1991 and 2000 values; results in all other columns are based on 2000 district attributes.

Table 3. Entry of Private Child Care Centers

Dependent variable: Births of private centers	2001-2006				
District attributes:	2000	2001-2006 (extrapol.)	1991	2000	2000
	(1)	(2)	(3)	(4)	(5)
Panel A					
Log population aged between 0 and 6	0.749***	0.768***	0.660***	0.778***	0.851***
	(0.101)	(0.103)	(0.0950)	(0.144)	(0.151)
Log income per capita	0.372***	0.372***	0.312**	0.364***	0.337***
	(0.119)	(0.113)	(0.142)	(0.123)	(0.130)
Number of public centers (lagged 1 year)				-0.005	
				(0.017)	
Enrollment in public centers (lagged 1 year)*1000					-0.041
					(0.049)
Log-pseudolikelihood	-1401.258	-1398.524	-1411.423	-1401.023	-1398.866
N	576	576	576	576	576
Panel B					
Log population aged between 0 and 6	0.819***	0.831***	0.790***	0.856***	0.921***
	(0.103)	(0.105)	(0.100)	(0.144)	(0.149)
Log average years of schooling pop. > 25 years old	1.426***	1.559***	1.118***	1.401***	1.335***
	(0.347)	(0.375)	(0.280)	(0.355)	(0.372)
Number of public centers (lagged 1 year)				-0.006	
				(0.017)	
Enrollment in public centers (lagged 1 year)*1000					-0.039
					(0.048)
Log-pseudolikelihood	-1391.154	-1389.045	-1394.670	-1390.814	-1388.922
N	576	576	576	576	576

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is Poisson. The unit of observation is district-year. All regressions include year dummies. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district. The period of analysis is 2001-2006.

Table 4. Births of Public Child Care Centers

Dependent variable: Births of public centers	2001-2006		
	(1)	(2)	(3)
Panel A			
Log population aged between 0 and 6	0.647***	0.446**	0.507***
	(0.127)	(0.184)	(0.184)
Log income per capita	-0.607***	-0.904***	-0.779***
	(0.173)	(0.255)	(0.223)
Number of private centers (lagged 1 year)		0.014*	
		(0.008)	
Enrolment in private centers (lagged 1 year)*1000			0.123
			(0.098)
Log-pseudolikelihood	-386.506	-384.359	-385.451
N	576	576	576
Panel B			
Log population aged between 0 and 6	0.711***	0.577***	0.639***
	(0.131)	(0.208)	(0.199)
Log average years of schooling pop. > 25 years old	-1.404***	-1.951**	-1.648***
	(0.464)	(0.759)	(0.636)
Number of private centers (lagged 1 year)		0.009	
		(0.010)	
Enrolment in private centers (lagged 1 year)*1000			0.061
			(0.108)
Log-pseudolikelihood	-388.977	-388.059	-388.716
N	576	576	576

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is Poisson. The unit of observation is district-year. All regressions include year dummies. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district. The period of analysis is 2001-2006.

Table 5. Teacher Qualifications in Private Centers

Dependent variable: % of teachers that have some higher education	All		center age >2		center age <3	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Day Care						
Log income per capita	0.143***	0.156***	0.158***	0.168***	0.154***	0.177***
	(0.010)	(0.015)	(0.011)	(0.016)	(0.012)	(0.021)
Log population aged between 0 and 6		0.015		0.013		0.028
		(0.012)		(0.012)		(0.018)
R2	0.098	0.099	0.103	0.103	0.090	0.091
N	11029	11029	5010	5010	3404	3404
Panel B: Preschool						
Log income per capita	0.161***	0.162***	0.164***	0.169***	0.171***	0.175***
	(0.014)	(0.023)	(0.016)	(0.025)	(0.015)	(0.024)
Log population aged between 0 and 6		0.001		0.006		0.005
		(0.022)		(0.025)		(0.021)
R2	0.092	0.092	0.091	0.091	0.087	0.087
N	13146	13146	5924	5924	4132	4132

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is OLS. The unit of observation is center-year. All regressions include year dummies. In columns (1) and (2) the period of analysis is 2000-2006. In columns (3) to (6), the period of analysis is 2002-2006 so that age categories can be determined. Local income per capita is measured in the year 2000. *** Significant at the 1 percent level;** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 6. Teacher Wages in Private Centers

Dependent variable: Log average teacher wage	2006/2007	
	(1)	(2)
Panel A		
Log income per capita, 2000	0.412***	
	(0.091)	
Log income per capita, 2006 (extrapolated)		0.381***
		(0.083)
R2	0.184	0.204
N	85	85
Panel B		
% of teachers that attended higher education	0.297	
	(0.186)	
% of teachers with complete BSc degree		0.396***
		(0.151)
R2	0.031	0.073
N	85	85

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is OLS. The unit of observation is center-year. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 7. Group Size in Private Centers

Dependent variable: log group class size	All		center age >2		center age <3	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Day Care						
Log income per capita	-0.211***	-0.194***	-0.199***	-0.186***	-0.179***	-0.154***
	(0.031)	(0.045)	(0.030)	(0.045)	(0.031)	(0.044)
Log population aged between 0 and 6		0.020		0.015		0.031
		(0.045)		(0.046)		(0.044)
R2	0.062	0.062	0.060	0.060	0.049	0.049
N	11029	11029	5010	5010	3404	3404
Panel B: Preschool						
Log income per capita	-0.127***	-0.112***	-0.125***	-0.124***	-0.138***	-0.101***
	(0.017)	(0.022)	(0.021)	(0.026)	(0.021)	(0.029)
Log population aged between 0 and 6		0.019		0.002		0.045
		(0.027)		(0.030)		(0.033)
R2	0.038	0.039	0.043	0.043	0.040	0.041
N	13146	13146	5924	5924	4132	4132

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is OLS. The unit of observation is center-year. All regressions include year dummies. In columns (1) and (2) the period of analysis is 2000-2006. In columns (3) to (6), the period of analysis is 2002-2006 so that age categories can be determined. Local income per capita is measured in the year 2000. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 8. Equipment in Private Centers

Dependent variable:	Computers per child		Has adequate sanitation for preschool?		Has playground?		Has fridge?	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log income per capita	0.039***	0.053***	0.025***	0.027**	0.008	0.008	0.014**	0.025***
	(0.009)	(0.013)	(0.008)	(0.012)	(0.006)	(0.010)	(0.007)	(0.009)
Log population aged between 0 and 6		0.018		0.003		0.001		0.013*
		(0.015)		(0.014)		(0.009)		(0.007)
Log pseudolikelihood			-2350.78	-2350.70	-1918.35	-1918.32	-1623.53	-1620.30
R2	0.011	0.012						
N	8127	8127	8127	8127	8127	8127	8127	8127

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method in columns (1) and (2) is OLS. The unit of observation is center-year. In columns (3) to (8) the method is Probit, from which marginal effects are reported.. Data for child care establishments providing both day care and preschool are used. Local income per capita is measured in the year 2000. All regressions include year dummies. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 9. Teacher Qualifications in Public Centers

Dependent variable: % of teachers with higher education	All		estab. age >2		estab. age <3	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Day Care						
Log income per capita	0.017	0.018	0.012	-0.001	0.035	0.063
	(0.012)	(0.020)	(0.016)	(0.026)	(0.025)	(0.039)
Log population aged between 0 and 6		0.0005		-0.014		0.031
		(0.016)		(0.022)		(0.028)
R2	0.201	0.201	0.150	0.151	0.124	0.126
N	2287	2287	1084	1084	659	659
Panel B: Preschool						
Log income per capita	0.096***	0.068***	0.098***	0.069***	0.072***	0.036
	(0.016)	(0.023)	(0.018)	(0.026)	(0.026)	(0.033)
Log population aged between 0 and 6		-0.032*		-0.034*		-0.040
		(0.019)		(0.020)		(0.033)
R2	0.111	0.113	0.133	0.136	0.084	0.086
N	4039	4039	2128	2128	1086	1086

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is OLS. The unit of observation is center-year. All regressions include year dummies. In columns (1) and (2) the period of analysis is 2000-2006. In columns (3) to (6), the period of analysis is 2002-2006 so that age categories can be determined. Local income per capita is measured in the year 2000. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 10. Group Size in Public Centers

Dependent variable: log average class size	All		estab. age >2		estab. age <3	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Day Care						
Log income per capita	-0.102***	-0.089**	-0.132***	-0.098**	-0.010*	-0.104
	(0.031)	(0.042)	(0.031)	(0.046)	(0.054)	(0.065)
Log population aged between 0 and 6		0.015		0.040		-0.005
		(0.028)		(0.035)		(0.041)
R2	0.241	0.241	0.389	0.392	0.132	0.132
N	2287	2287	1084	1084	659	659
Panel B: Preschool						
Log income per capita	-0.019	-0.034**	-0.009	-0.031*	-0.019	-0.042
	(0.012)	(0.017)	(0.013)	(0.017)	(0.022)	(0.040)
Log population aged between 0 and 6		-0.018		-0.026*		-0.027
		(0.015)		(0.013)		(0.040)
R2	0.138	0.139	0.073	0.074	0.104	0.105
N	4039	4039	2128	2128	1086	1086

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method is OLS. The unit of observation is center-year. All regressions include year dummies. In columns (1) and (2) the period of analysis is 2000-2006. In columns (3) to (6), the period of analysis is 2002-2006 so that age categories can be determined. Local income per capita is measured in the year 2000. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 11. Equipment in Public Centers

Dependent variable:	Computers per child		Has adequate sanitation for preschool?		Has playground?		Has fridge?	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log income per capita	0.011**	0.013**	0.015	0.028	0.015	0.011	-0.003	0.0003
	(0.005)	(0.006)	(0.022)	(0.033)	(0.031)	(0.043)	(0.010)	(0.017)
Log population aged between 0 and 6		0.003		0.015		-0.004		0.003
		(0.002)		(0.021)		(0.033)		(0.014)
Log pseudolikelihood			-237.723	-237.119	-422.176	-422.152	-120.431	-120.409
R2	0.062	0.065						
N	963	963	963	963	963	963	963	963

Source: Authors' computations based on data described in Section 4.
Notes: The estimation method in columns (1) to (2) is OLS. In columns (3) to (8) it is Probit, from which marginal effects are reported. Data for child care establishments providing both day care and preschool are used. *** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level. Robust standard errors in parenthesis clustered by city district.

Table 12. Proportion of Private Centers Operating below Minimum Quality Standards, 2006

	Minimum standards	Group size				Staff-ratio				Teacher qualifications			
		All	High-inc	Med-inc	Low-inc	All	High-inc	Med-inc	Low-inc	All	High-inc	Med-inc	Low-inc
Panel A: Day care	Brazil recommended	12.4	10.1	9.2	19.3	-	-	-	-	35.4	21.4	36.1	51.5
	U.S. 10th percentile	9.6	6.9	6.9	16.3	40.6	29.9	42.2	52.0	35.4	21.4	36.1	51.5
	U.S. 50th percentile	24.6	20.5	21.2	34.0	57.7	48.3	58.7	67.9	35.4	21.4	36.1	51.5
	U.S. 90th percentile	56.6	51.2	53.2	67.4	79.0	71.3	80.6	86.7	82.7	71.6	85.2	93.2
Panel B: Preschool	Brazil recommended	4.5	2.7	4.3	6.6	-	-	-	-	1.9	1.7	1.6	2.2
	U.S. 10th percentile	1.7	0.8	2.3	2.1	15.9	9.0	16.0	23.3	1.9	1.7	1.6	2.2
	U.S. 50th percentile	8.2	4.7	6.9	13.4	32.9	22.4	32.7	44.8	1.9	1.7	1.6	2.2
	U.S. 90th percentile	17.1	11.0	14.6	26.7	46.8	32.6	45.4	64.0	75.8	57.8	75.7	89.5

Source: Data on recommended minimum standards for São Paulo come from SEBRAE (2005). Data on US regulations come from Hotz and Xiao (2010)

Notes: The distribution of US regulations across states refers to the year 1996. For each state, we consider average regulations for day care and preschool.