NBER WORKING PAPER SERIES

PROVISION OF CHILD CARE: COST FUNCTIONS FOR PROFIT-MAKING AND NOT-FOR-PROFIT DAY CARE CENTERS

Swati Mukerjee

Anne Dryden Witte

Sheila Hollowell

Working Paper No. 3345

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 1990

NBER Working Paper #3345
April 1990

PROVISION OF CHILD CARE: COST FUNCTIONS FOR PROFIT-MAKING AND NOT-FOR-PROFIT DAY CARE CENTERS

ABSTRACT

This paper estimates cost functions for day care centers in Massachusetts. The production technology assumed is the generalized homothetic Cobb-Douglas production function. The cost function dual to this production function is estimated separately for profit-making (PMOs) and not-for-profit (NPOs) organizations. The results are discussed in the context of current NPO literature. NPOs are found to be operating at higher average costs than PMOs for most output levels as predicted by the literature. However, the provision of more staff per child hour, our measure of quality, increases costs by similar amounts in PMOs and NPOs. Further, present forms of subsidies do not help either PMOs or NPOs, and in fact, promote 'shirking' in NPOs. PMOs are not optimizing with reference to the amount of education and experience in their personnel. The results suggest that experienced labor may be working for less than its marginal product in the day care industry.

Swati Mukerjee
Bentley College
Waltham, MA 02154

Anne Dryden Witte
Wellesley College
Wellesley, MA 02181

Sheila Hollowell
Wellesley College
Wellesley, MA 02181

I. Introduction

The need for affordable child care arrangements has escalated in recent years as a result of two demographic trends: the rapid, continuing increase in maternal employment in the last decade and a half and an even higher increase in the number of single parent households.[1] Crucial to the affordability issue is the need to study the factors underlying the cost of providing high quality daycare. This paper focuses on these cost determinants in the case of day care centers in Massachusetts. The latter comprise a significant subset of all day care options[2] caring for 16% of infants, 31% of toddlers, 66% of pre-schoolers and 7% of schoolgoing children in non-parental care.[3] Since not all the daycare centers are profit oriented, this was an excellent opportunity to study both profit (PMO) and not-for-profit (NPO) organizations co-existing in the same industry. Most previous work has focused on modeling the demand for child care (e.g., Robins and Spiegelman, 1978 and Henriques and Vaillancourt, 1988). Two exploratory studies analyzing the costs of providing day care are now over a decade old. See Robins and Weiner (1978) and Ruopp, et al. (1979). Robins and Weiner sought to determine the factors affecting the price (rather than cost) of day care. Their sample targeted low income families in Denver and Seattle. Their model is, however, really a revenue function and not a cost function as their dependent variable measures weekly revenues of the center. A revenue function includes the net profit or net loss of the center which a cost function does not. The second study, by Ruopp, et al. is the 1977 National Day Care Study by Abt Associates, which uses a random sample of licensed centers. Both studies adjusted for heterogeneity in output by including a staff/child ratio as an indicator of quality. They also included the average experience and educational levels of the staff. In the present study, cost functions for both profit and nonprofit

day care centers have been estimated separately, refining the measurements of quality, and comparing and interpreting the results in the context of current literature, in particular, the shirking and property rights models for NPOs.

When property rights are reduced, negative consequences may occur (Clarkson 1980). See James and Susan Rose-Ackerman (1986) for a concise survey of existing empirical studies testing various implications of the property right model as applied to NPOs.[4] As regards the relative costs of the PMOs and NPOs, they may be expected to behave in exactly the same way if entry is restricted and when maximum expected profits are zero. But in the long run, if donations are present, or if the nonprofit status is taken by the consumers as signalling higher quality, one may expect higher costs in NPOs. These costs may be higher for various reasons: shirking, quality becoming an important NPO objective, or technological preference for particular factor mixes (e.g., generous expense accounts, sophisticated decor, etc.). The present study extends the scope of current empirical studies of the relative performance of PMOs and NPOs to the daycare industry.

The paper is structured as follows. Section II discusses the theoretical issues and the major factors determining the costs of day care centers. Section III describes the data and the empirical formulation of the model. The results are in Section IV and Section V concludes the paper and suggests extensions.

II. The Theoretical Underpinnings

At its simplest, a firm's total cost function may be denoted as:

$$TC = f(Q, P_I)$$

i.e., total expenditures (TC) are related to the level of output Q, the cost of its inputs P_I, and the type of production technology represented in the functional form, f. Specification of a cost function does not imply any restriction on the market structure. However, the derivation of a supply curve from a cost function involves the assumption of competitive conditions which, *prima facie*, does not seem appropriate in this subsector of the day care industry. Thus we make no attempt to estimate a supply curve. The latter would require a careful formulation of the appropriate model for the day care industry and a simultaneous estimation of both supply and demand.[5]

The simple formulation of the total cost function involves certain restrictive assumptions. Output must be homogenous, all differences in factor inputs fully reflected in their price and factor-embodied technology absent. The daycare industry does not fit this mold. Output is not homogeneous, either within or between firms, and it is possible that total costs are affected by the education and experience of the staff even after controlling for wage level. The technology of day care production is the manner in which day care is provided. Though some of the technology may be disembodied (i.e., independent of the level of education and experience of the staff) some may not be so separated from the factors of production.

In selecting an appropriate functional form, we considered the different restrictions that various functional forms impose. The simplest, the generalized Cobb-Douglas production function, allows returns to scale to be increasing or decreasing for all output levels, but does not let them depend on the output level. Further, the elasticity of substitution is constrained at unity. Functional forms that allow returns to scale and/or the elasticity of substitution to vary with output are available. One may choose from the

class of homothetic functions allowing returns to scale to vary with output. Even more attractive theoretically are the flexible forms which place few restrictions on technology. See for example, the translog (Christensen, Jorgensen, and Lau, 1973), the generalized quadratic (Denny, 1974) and the generalized Leontief (Diewert, 1971). However, the large number of parameters to be estimated in a flexible form call into question the precision of estimates in a reasonably sized data set. The other problem that arises is in the presence of a wide range of observations in the data set, in which case the flexible forms may fail to fulfill certain restrictions (e.g., diminishing marginal physical product). These considerations led us to consider the class of homothetic functions as good candidates for selection. We chose the generalized homothetic Cobb-Douglas functional form, first proposed by Zellner and Revankar (1970).

The cost function dual to this production function has the following specification:

$$TC = B_0 + B_1 Y_i + B_2 \ln Y_i + (\ln P_i)' B_3 + (\ln X_i)' B_4 + E_i$$

where TC is the dependent variable denoting total costs; Y_i is output; P_i is the vector of explanatory price variables; X_i is the vector of non-price explanatory variables; B_0, B_1, B_2 are parameters to be estimated; B_3, B_4 are vectors of parameters to be estimated and E_i is the random disturbance term.

III. The Data and Empirical Formulation of the Model

The data are for a random sample of day care centers in Massachusetts.[6] The dependent variable, total costs, is the weekly expenditure of each center

summing up all labor, capital, supplies, food, transportation, utilities, phone, liability insurance and other costs. The independent variables are discussed below.

The output of a center is the total number of child hours provided by the center during the year. This is the sum of the hours spent by all children resident at a center in that year.

The price of labor is the personnel costs, fringe benefits and payroll taxes divided by total paid staff hours. To arrive at the total capital cost for a center, we add up rent/mortgage payments, utilities, and maintenance and repair costs. This aggregate is divided by the total number of rooms to yield the price of capital. Adding up costs of supplies, equipment, food, phone services and transportation, and then dividing by the number of children gives us the price of materials.

Day care centers receive a range of subsidies: state food program allocations, donations, funds from endowments, supplies brought in by parents, volunteer hours and DSS[7] funding. Since these subsidies fall naturally into two groups, two subsidy variables were created. Subsidy 1 is a binary variable equal to one if the center used volunteer hours and zero if the center did not. Subsidy 2 is a binary variable equal to one if the center received state funding items (state food and DSS), financial subsidies such as endowments and loans, or funding from private organizations or the United Way. These subsidies may be expected to lower costs for PMOs, but prima-facie, it is not possible to say how they may affect NPOs. In the latter case the use of subsidies may actually increase costs (for example, they may be used for staff perquisites). Costs may also rise due to unmeasured improvements in quality. For instance, better and more varied play equipment may be bought.

Since output of day care centers is not homogenous, one has to control for quality. Quality is a multi-dimensional concept, and in the day care situation, good quality care may be envisioned as one where the child receives individual attention and interaction, emotional support and care, the teaching of universally accepted values, and the fostering of individuality, creativity, etc. Measuring these is beyond the scope of this study, but one may try to isolate objective factors or attributes that create or encourage such a nurturing environment. An important one is the degree of interaction of the provider with the child. Previous studies have used the staff to child ratio as a quality measure. This does not take into account the reality that the staff also spend time away from the children in administrative duties and that all children do not require the same degree of care and supervision. To capture these features, the ratio of weekly paid staff hours in the classroom to the number of children (weighted) is computed.[8] We realize that this ratio may not capture all the aspects of quality.

The next two variables relate to education and experience. To reflect the diverse educational levels of the staff in any daycare center, we construct a variable that indicates the average education of the staff. The experience variable is created by taking the weighted average of the total years of experience possessed by the staff. This reduces the range of staff experience in any one center to a scalar. It is unclear how parameter estimates on these two variables should be interpreted. They may be reflecting technology embodied in labor. In that case, there is the possibility that as more technology is incorporated into labor, certain aspects of quality (for example, the fostering of creativity in children) may be enhanced. Alternatively, this labor embodied technology may lower costs.

The coefficients on these variables may also measure marginal productivity not included in labor price. To the extent these two variables measure quality, we would expect a positive relationship to costs. However, to the degree they reflect cost-reducing technological change or differences in marginal productivity not reflected in labor price, we would expect negative coefficients.

IV. The Results

A. For-Profit Centers (PMOs)

The model was estimated by OLS. The regression results are reported in Table 2. The residual plots did not indicate significant heteroskedasticity and therefore no data transformations were made. The adjusted R^2 is 0.83 and the F statistic is significant at any reasonable level of statistical significance. The collinearity diagnostics using eigen values (following Belsley, et al., 1980) do not show any significant multi-collinearity.

Turning to the coefficients on output and input prices, the results are generally as expected. Total cost goes up with an increase in any factor cost. The elasticities of total cost with regard to capital and material prices are 0.24 and 0.17 respectively, whereas the elasticity of total cost with respect to labor price is the highest, at 0.81. This is not unexpected considering labor costs constitute the largest share of total costs. Further, increases in output reduce average costs significantly, indicating the presence of economies of scale. See Figure 1.

As the ratio of the paid staff class hours to weighted children (henceforth called QUALR) increases, costs go up. A 10% increase in QUALR would lead to a 3.7% increase in total costs. Assuming equilibrium in the day

care market, these results imply an insignificantly different market valuation (or the marginal willingness to pay by consumers of day care) for increasing staff-child ratio.

The coefficients of both education and experience variables are significant and negative. Recall from our earlier discussion that a negative coefficient could reflect cost-reducing technical change and/or differences in marginal productivity not captured in labor price. It is not possible, however, in the present model, to separate out the two effects.

B. Not for Profit Centers (NPOs)

The regression results for the NPOs are reported in Table 2. The adjusted R^2 is 0.82 and the F statistic is significant at any reasonable level of statistical significance. As in the previous case, the results with regard to material and labor costs are consistent with economic theory. However, the elasticities of total cost in relation to all input prices are much lower for NPOs than PMOs. Total costs go up by 2.6% when labor costs increase by 10%. This is less than a quarter of the rate of increase experienced by PMOs. As for PMOs, total costs are affected to a smaller degree (2.0%) when material costs increase by the same magnitude. An increase in the price of capital, though, has no significant effect on costs. NPOs like PMOs experience increasing returns to scale. However, note in Figure 1 that the average cost of NPOs is greater than that for PMOs for most output levels.

NPOs share three results with PMOs: there are economies of scale; as the staff-child ratio increases, costs are affected positively; as average experience increases, costs go down.[9] However, they differ from PMOs in that an improvement in education has no significant effect on costs.[10] This

appears to indicate that quality improvements acted as an offsetting force. The fact that the coefficient on education is insignificant also suggests that NPOs may have increased the education level to its optimum, in contrast to PMOs who have not done so. Another difference between the two forms of organizations is that contributions of volunteer hours actually increased costs.

C. Comparison of PMOs and NPOs

Since the day care industry gave us an excellent opportunity to study a case where both PMOs and NPOs coexist, we can examine the results further in the light of current literature on NPOs. The first question we sought to answer was whether the cost functions of the two types of centers were the same or whether the two samples had been drawn from different populations. To test for the equivalence of the two regression equations, we used the Chow test[11] and found the relevant F statistic significant at the .01 level. This lent justification to the separate treatment of PMOs and NPOs, and implies that if PMOs are minimizing costs, then the other centers are not doing so. Indeed, NPOs do, for most ouput levels have higher average costs than PMOs (See Figure 1).

Will giving donations worsen matters? In this context, James and Susan Rose-Ackerman[12] succinctly summarize current theoretical thinking on NPOs.

> Shirking is possible in the long run only if there are barriers to entry, if donations are positive for some organizations, or if some customers prefer nonprofits as more 'trustworthy.' Ironically, donations and trust make things worse rather than better in this respect. In effect, 'shirking' is one possible use of donation and other revenues induced by trust.

Further,

> Put another way, in situations where a profit oriented market will not produce efficient amounts (as where externalities exist), mechanisms (such as voluntary donations) that allow increased production also allow productive inefficiency (excess capacity, shirking) and society faces a trade-off between the two kinds of inefficiency.

Donations in our sample are given in different ways: as direct funding and/or as aid in the form of volunteer hours. Our results show that donations have no effect on PMOs. In NPOs, however, volunteer hours have the effect of actually increasing costs thus providing support to the 'shirking' hypothesis. On the other hand, in both PMOs and NPOs, a reduction in the price of labor would decrease costs. Therefore, any form of subsidy that reduces the cost of labor should reflect in a cost reduction in both forms of organization. A reduction in the price of capital, however, does not reduce appreciably costs in an NPO. These results impel us to conclude that in the main, present forms of subsidy are not helping to lower day care costs at all, and in fact are promoting 'shirking' in NPOs. Designing subsidies that <u>would</u> help decrease costs must lower effective prices of labor, materials and capital in a PMO, and that of labor and materials in an NPO.

Where quality is observable, NPO models usually agree that NPO managers may tend to overemphasize quality which leads to higher costs for NPOs relative to PMOs. On the other hand, where quality is <u>not</u> easily observed and measured as in the Hansmann model,[13] consumers are unable to make enforceable contracts in regard to these characteristics. This could be the case in areas

such as health and education, and PMOs in these industries would then have a tendency to downgrade quality, whereas NPOs would have an attenuated pecuniary incentive to do the same.

The daycare industry can be categorized as one where quality may be observed (with cost), but may not be enforceable contractually. Our results indicate that, improving quality increases costs for both organizations. However, a 10% increase in the staff-child ratio increases total costs by 3.3% in an NPO, as against 3.7% in a PMO. Since the test of the null hypothesis that the two parameters are equal cannot be rejected, increases in the staff-child ratio at PMOs and NPOs imply similar increases in costs. This suggests similar market valuations of quality under competitive market conditions.

Accumulation of experience decreases costs significantly for both organizations. This indicates that both should value experience for its cost reducing potential. Recall (see Table 1) that the average experience was significantly higher in PMOs. This is consistent with attempts to maximize profits by PMOs. However, our results suggest that both PMOs and NPOs could lower costs further by increasing the experience of their staff. We do not have the data to furnish an explanation for center's failure to hire more experienced staff. We speculate there may be supply constraints in the labor market. We have already discussed the fact that PMOs are not optimizing with regard to education either, and it now appears that NPOs place a greater emphasis on education over experience.

We are left with an intriguing picture. The average wage is significantly higher in NPOs than PMOs (see Table 1). PMOs are not optimizing with regards to either education or experience, and NPOs are not optimizing with regards to experience. An explanation could be that all centers are

constrained from hiring staff with the desired level of experience because of market constraints. Interestingly, NPOs appear to have been able to hire staff with cost minimizing levels of education while PMOs have not been able to do so.

V. Conclusion

The present study estimated cost functions for PMOs and NPOs in the day care industry in Massachusetts from cross-section data collected in 1987 and 1988. The results are discussed in the context of the NPO literature. The two forms of organization are seen to be drawn from different populations: the parameters of the estimated cost functions are significantly different. One may surmise that if the PMOs are cost-minimizing, their non-profit counterparts are not doing so since they are operating at higher average cost for most output levels. See Figure 1. Giving financial subsidies like donations, loans etc. do not help reduce costs. Present forms of subsidy are, at best, quite ineffective. To lower costs, subsidies must lower the effective prices of material, labor and capital for PMOs. For NPOs, however, the options are narrower. Only subsidies that affect labor and material prices would serve to lower costs. In fact, donation of volunteer hours actually elevates costs in NPOs. This lends credence to the 'shirking' models. Clearly the most effective method of lowering child care costs is to lower the unit labor cost faced by both NPO and PMO producers. A recent study in Massachusetts (Wellesley College Center for Research on Women and Center for Survey Research, University of Massachusetts at Boston, 1988) suggests that this may best be accomplished by providing NPOs with wage grants and PMOs with tax credit related to their labor costs.

Raising the staff-child ratios increases costs of both PMOs and NPOs. As predicted by the NPO literature, PMOs have lower ratios of paid staff class hours to the number of children.[14] If PMOs are providing the "correct" staff-child ratios then NPOs are overproducing quality. This is consistent with the contention in the not-for-profit literature that NPOs will overproduce quality. Having staff with more education and experience reduces costs in PMOs, whereas NPOs seem to benefit only from staff with greater experience. Consistent with cost minimization, we would then expect PMOs to have more experienced and educated staff in an attempt to lower costs. In practice, the staff of PMOs does have more experience on the average. However, the staff of PMOs and NPOs do not differ significantly in average education.

There are a number of possible explanations for the negative coefficients on education and experience. One possible explanation is that more experienced and better educated staff are receiving wages that are less than their marginal product, particularly, in for-profit centers. It is interesting in this regard that average wages are significantly higher in NPOs than in PMOs.

Several issues require further research. The fact that the output in the daycare industry requires both client and provider inputs makes this a special case of joint production, compounding the usual difficulties of measuring output in service industries. Further, an analysis of cost functions is only a first step towards building a complete model of price determination to be used for a full examination of the affordability issue.

Footnotes

1. "Among working women with husbands present and children under 6, 30% were in the labor force in 1970. By 1984, 48% of such women were working. The US Congressional budget office predicts that by 1990, 55% of this group will be working and 60% of all new labor force entrants will be women." See page 1 of Marshall et al. (1987).

2. The range of options open to parents could include, apart from formal center-based care, those provided by family daycare whether licensed of unlicensed, care by relatives and baby sitters at home. See pages 4-8 of Marshall et al. (1987).

3. Infants ..... children between 0-14 months.

   Toddlers .....15-32 months.

   Preschoolers .....33-59 months.

4. For instance, see Frech (1980), and Blair, Ginsburg and Vogel (1975) for the health insurance industry. Clarkson (1980) and Bays (1979) have studied nonprofit hospitals and Feigenbaum (1983) medical charities.

5. This is the subject of a separate paper by the authors.

6. The data set contains information for centers selected randomly from two sampling frames. The first sampling frame was the licensing lists of the Massachusetts Office for Children. The data for 86 centers from this sampling frame are used. The second was the centers used by a random sample of Massachusetts families with children under the age of thirteen. The data for 27 centers were selected from this sampling frame. The addition of the second set of centers in February 1988, tends to overcome well-known deficiencies in

the licensing list sampling frames (e.g., incomplete and out-of-date lists). See Marshall, et al. (1987) for details.

7. The Department of Social Services (DSS) provides funding for families based on need. This subsidy is given directly to the centers.

8. The weights were obtained by regressing the total number of infants, toddlers, pre-schoolers, kindergartners, and school age children to paid staff class hours.

9. We cannot reject the null hypothesis that the parameters of the experience variable are equal in PMOs and NPOs.

10. The null hypothesis that the education parameters across the two equations are equal is rejected at the .01 level of significance.

11. See Gregory C. Chow (1960).

12. See page 38 of James and Rose-Ackerman (1986).

13. See Hansmann 1980, 1986.

14. The relevant null hypothesis is not rejected at the .10 level of statistical significance.

References

Bays, C. W. 1979. Costs comparisons of for-profit and nonprofit hospitals. *Social Science and Medicine* 13.

Belsley, D.A., E. Kuh and R.E. Welsch. 1980. Regression Diagnostics: Identifying Influential Data and Sources of Collinearity. New York: John Wiley.

Blair, R., P. Ginsburg and R. Vogel. 1975. Blue Cross-Blue Shield administration costs: A study of nonprofit health insurers. *Economic Inquiry* 13:237-251.

Chow, G. C. 1960. Tests on equality between sets of coefficients in two linear regressions. *Econometrica* 28(3):591-605.

Christensen, L. R., D. W. Jorgensen, and L. J. Lau. 1973. Transcendental logarithmic production functions. *Review of Economics and Statistics* 55:28-45.

Clarkson, K. 1972. Some implications of property rights in hospital management. *Journal of Law and Economics* 15:363-384.

Clarkson, K. and D. Martin, eds. 1980. *The economics of nonproprietary organizations*. Greenwich, CT: JAI Press.

Denny, M. 1974. The relationship between functional forms for the Production system. *Canadian Journal of Economics* VII:21-31.

Diewert, W. E. 1971. An application of the Shephard duality theorem: A generalized Leontief. *Journal of Political Economy* 70:481-507.

Feigenbaum, S. 1983. Competition and performance in the nonprofit: The case of medical research charities. Mimeo.

Frech III, H. E. 1980. Health insurance: Private, mutual, or government. In *The economics of nonproprietary organizations* ed. Clarkson and Martin. Greenwich, C.T.: JAI Press.

Hansmann, H. 1986. Economic theories of nonprofit organizations. In *Between the public and the private: The nonprofit sector* ed. W. Powell. New Haven: Yale University Press.

————. 1980. The role of non-profit enterprise. *Yale Law Journal* 89:835-898.

Henriques, I. and F. Vaillancourt. 1988. The demand for child care services in Canada. *Applied Economics* 20:385-394.

James, E. and S. Rose-Ackerman. 1986. *The nonprofit enterprise in market economics*. New York: Harwood Academic Publishers.

Marshall, N. L. and A. D. Witte, et al. 1987. *Report of the child care affordability study*. Center For Research on Women, Wellesley College.

Robins, P. K. and R. G. Spiegelman. 1978. An econometric model of the demand for child care. *Economic Inquiry* XVI:83-94.

Robins, P. K. and S. Weiner. 1978. *Child care and public policy*. Lexington, Mass.: Lexington Books.

Ruopp, R. and J. Travers, et al. 1979. *Children at the center*. Cambridge, Mass.: Abt Associates.

Wellesley College Center for Research on Women and Center for Survey Research, University of Massachusetts at Boston. 1988. *Caring for our commonwealth: The economics of child care in Massachusetts*. Boston, Mass.: Massachusetts' Office for Children.

Zellner, A. and N. Revankar. 1970. Generalized production functions. *Review of Economic Studies* 37:241-250.

Figure 1

Average Costs to Daycare Centers

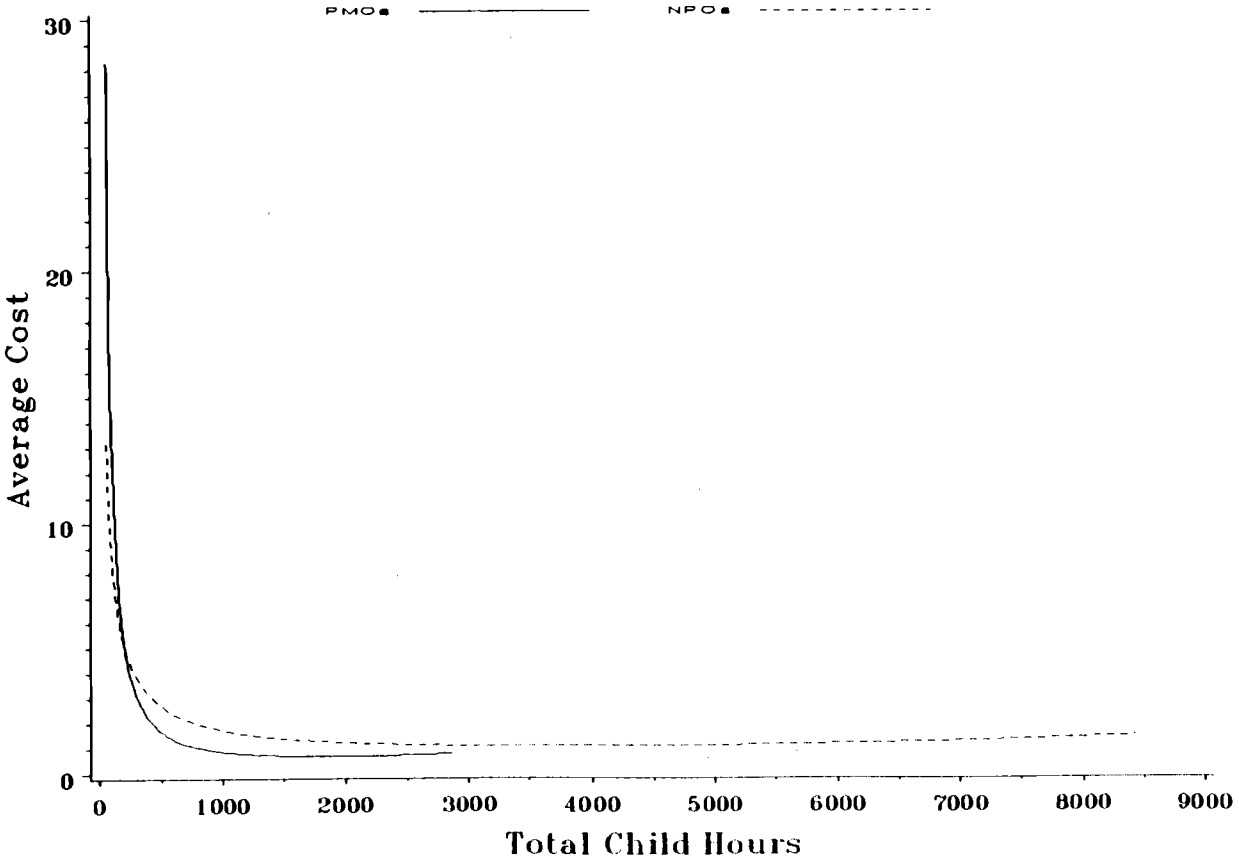

Table 1
Descriptive Statistics for Day Care Centers in Massachusetts

	Mean (Standard Deviation)		T Statistic for Test of Difference in Means	Variable Definition
Variable	PMO Sample	NPO sample		
TOTEXP	1583.69 (1425.19)	3684.32 (5603.87)	-0.36	Total Expenditure Per Week
CHRS	1689.51 (5174.70)	1347.78 (1486.67)	0.41	Total Number of Hours Children Are Cared For Per week
PLAB	6.35 (2.76)	9.74 (8.13)	3.22	Total Labor Costs Per Hour
PCAP	337.97 (364.20)	243.74 (553.77)	1.08	Price Per Room Per Month
PMAT	55.90 (250.71)	18.40 (18.07)	0.96	Expenditure for Materials per Month per Child
QUALR	0.56 (0.52)	0.75 (0.54)	-1.73	Ratio of Paid Staff Classroom Hours/Children
QUALED	4.38 (1.16)	4.44 (1.15)	-0.11	Average Education of Staff
QUALEX	7.33 (2.70)	6.18 (2.63)	2.20	Average Experience of Staff
SUB1DUM	0.46 (0.50)	0.57 (0.50)		Dummy Variable = 1 If Had Donation of Time by Volunteers or Parents
SUB2DUM	0.15 (0.36)	0.44 (0.50)		Dummy Variable = 1 Received Any State or Private Funding

Table 2
Cost Function Estimates for Day Care Centers in Massachusetts

	Coefficient Estimate (|t| in parentheses)		t-value for test of difference of estimates
Variable	PMO Sample	NPO Sample	
Constant	9.399 (4.211)	4.743 (4.972)	1.918
CHRS	0.0008 (2.609)	0.0002 (2.768)	2.000
LNCHRS	-0.502 (1.798)	0.227 (1.911)	0.908
LNPLAB	0.798 (4.231)	0.252 (2.436)	2.516
LNPCAP	0.216 (2.140)	0.075 (1.402)	1.240
LNPMAT	0.154 (1.895)	0.180 (1.801)	0.200
LNQUALR	0.326 (2.178)	0.252 (2.260)	3.895
LNQUALED	-0.929 (2.756)	0.033 (0.125)	2.253
LNQUALEX	-0.609 (2.759)	-0.290 (1.657)	1.130
SUB1DUM	-0.163 (0.937)	0.270 (1.963)	1.959
SUB2DUM	0.101 (0.374)	0.187 (1.134)	0.273
R^2 [adj. R^2]	0.8204 [0.7585]	0.7954 [0.7499]	
F [Prob > F]	13.250 [0.0001]	17.492 [0.0001]	

Number	Author	Title	Date
3289	Dagobert L. Brito Jonathan H. Hamilton Steven M. Slutsky Joseph E. Stiglitz	Randomization in Optimal Income Tax Schedules	3/90
3290	Kenneth R. French James M. Poterba	Are Japanese Stock Prices Too High?	3/90
3291	Scott J. Brown N. Edward Coulson Robert F. Engle	Non-Cointegration and Econometric Evaluation of Models of Regional Shift and Share	3/90
3292	Tetsuji Yamada Tadashi Yamada Guorn Liu	Determinants of Saving and Labor Participation of the Elderly in Japan	3/90
3293	Robert E. Lipsey	American Firms Face Europe: 1992	3/90
3294	Robert Topel	Specific Capital, Mobility, and Wages: Wages Rise With Job Seniority	3/90
3295	Robert S. Pindyck	Inventories and the Short-run Dynamics of Commodity Prices	3/90
3296	G. William Schwert	Stock Returns and Real Activity: A Century of Evidence	3/90
3297	Charles R. Nelson Myung J. Kim	Predictable Stock Returns: Reality or Statistical Illusion?	3/90
3298	Partha Sen Steven J. Turnovsky	Investment Tax Credit in an Open Economy	3/90
3299	Kathryn Dominguez Jeffrey Frankel	Does Foreign Exchange Intervention Matter? Disentangling the Portfolio and Expectations Effects for the Mark	3/90
3300	Dani Rodrik	Premature Liberalization, Incomplete Stabilization: The Ozal Decade in Turkey	3/90
3301	Zvi Griliches	Patent Statistics as Economic Indicators: A Survey Part I and II	3/90
3302	Rudiger Dornbusch	From Stabilization to Growth	3/90
3303	Roger H. Gordon	Do Publicly Traded Corporations Act in the Public Interest?	3/90
3304	Irving B. Kravis Robert E. Lipsey	The International Comparison Program: Current Status and Problems	3/90

Number	Author	Title	Date
3305	John Y. Campbell	Measuring the Persistence of Expected Returns	3/90
3306	Takatoshi Ito Masayoshi Maruyama	Is the Japanese Distribution System Really Inefficient?	3/90
3307	Robert Pindyck	Irreversibility, Uncertainty, and Investment	3/90
3308	Edward J. Kane	Incentive Conflict in the International Regulatory Agreement on Risk-Based Capital	3/90
3309	Donald R. Haurin Patric H. Hendershott Dongwook Kim	Real Rents and Household Formation: The Effect of the 1986 Tax Reform Act	3/90
3310	Donald R. Haurin Patric H. Hendershott Dongwook Kim	Tenure Choice of American Youth	3/90
3311	K.C. Chan Patric H. Hendershott Anthony B. Sanders	Risk and Return on Real Estate: Evidence from Equity REITs	3/90
3312	Joshua D. Angrist	Does Labor Supply Explain Fluctuations in Average Hours Worked?	3/90
3313	John F. Helliwell	Fiscal Policy and the External Deficit: Siblings, but not Twins	4/90
3314	Ryuzo Sato Rama V. Ramachandran Bohyong Kang	Risk Adjusted Deposit Insurance for Japanese Banks	4/90
3315	Stephen J. Turnovsky	Tariffs and Sectoral Adjustments in an Open Economy	4/90
3316	Richard Arnott Joseph Stiglitz	The Welfare Economics of Moral Hazard	4/90
3317	Robert J. Barro Xavier Sala i Martin	World Real Interest Rates	4/90
3318	Michael D. Whinston Scott C. Collins	Entry, Contestability, and Deregulated Airline Markets: An Event Study Analysis of People Express	4/90
3319	Richard E. Baldwin	Re-Interpreting the Failure Exchange Market Efficiency Tests: Small Transaction Costs, Big Hysteresis Bands	4/90

Number	Author	Title	Date
3320	Linda S. Goldberg	Predicting Exchange Rate Crises: Mexico Revisited	4/90
3321	John M. Abowd Richard B. Freeman	The Internationalization of the U.S. Labor Market	4/90
3322	Gary S. Becker Michael Grossman Kevin M. Murphy	An Empirical Analysis of Cigarette Addiction	4/90
3323	Frederic S. Mishkin	Financial Innovation and Current Trends in U.S. Financial Markets	4/90
3324	Robert S. Pindyck Julio J. Rotemberg	Do Stock Prices Move Together Too Much?	4/90
3325	Sergio Rebelo	Long Run Policy Analysis and Long Run Growth	4/90
3326	Fumio Hayashi Tohru Inoue	The Relation Between Firm Growth and Q with Multiple Capital Goods: Theory and Evidence from Panel Data on Japanese Firms	4/90
3327	Roger H. Gordon	Canada - U.S. Free Trade and Pressures for Tax Harmonization	4/90
3328	Willem H. Buiter Kenneth M. Kletzer	Fiscal Policy Interdependence and Efficiency	4/90
3329	Willem H. Buiter Kenneth M. Keltzer	The Welfare Economics of Cooperative and Noncooperative Fiscal Policy	4/90
3330	S. Rao Aiyagari Lawrence J. Christiano Martin Eichenbaum	The Output, Employment, and Interest Rate Effects of Government Consumption	4/90
3331	Alan L. Gustman Olivia S. Mitchell	Pensions and Labor Market Activity: Behavior and Data Requirements	4/90
3332	Richard C. Marston	Systematic Movements in Real Exchange Rates in the G-5: Evidence on the Integration of Internal and External Markets	4/90
3333	Alberto Giovannini James R. Hines, Jr.	Capital Flight and Tax Competition: Are There Viable Solutions to Both Problems?	4/90
3334	Alan B. Krueger	Ownership, Agency and Wages: An Examination of Franchising in the Fast Food Industry	4/90

Number	Author	Title	Date
3335	Matthew Richardson James H. Stock	Drawing Inferences from Statistics Based on Multi-Year Asset Returns	4/90
3336	Charles Brown	Wage Levels and Method of Pay	4/90
3337	Charles Brown	The Quality Dimension of Army Retention	4/90
3338	Robert G. King Sergio Rebelo	Public Policy and Economic Growth: Developing Neoclassical Implications	4/90
3339	R. Glenn Hubbard Anil Kashyap	Internal Net Worth and the Investment Process: An Application to U.S. Agriculture	4/90
3340	Anne O. Krueger	Government Failures in Development	4/90
3341	David F. Bradford	What is International Saving?: Alternative Measures in Historical and International Context	4/90
3342	David G. Blanchflower Richard B. Freeman	Going Different Ways: Unionism in the U.S. and Other Advanced O.E.C.D. Countries	4/90
3343	Axel Boersch-Supan Vassilis Hajivassiliou Laurence J. Kotlikoff John N. Morris	Health, Children, and Elderly Living Arrangements: A Multiperiod-Multinomial Probit Model With Unobserved Heterogeneity and Autocorrelated Errors	4/90
3344	Jess Benhabib Richard Rogerson Randall Wright	Homework in Macroeconomics I: Basic Theory	4/90
3344	Jess Benhabib Richard Rogerson Randall Wright	Homework in Macroeconomics II: Aggregate Fluctuations	4/90
3345	Swati Mukerjee Anne Dryden Witte Sheila Hollowell	Provision of Child Care: Cost Functions for Profit-Making and Not-for-Profit Day Care Centers	4/90

Note: Copies of the above working papers can be obtained by sending $2.00 per copy to Working Papers, NBER, 1050 Massachusetts Avenue, Cambridge, MA 02138. Advance payment is required on all orders. Please make checks payable to the National Bureau of Economic Research.