THE COST OF HIGH-QUALITY PRE-SCHOOL EDUCATION IN NEW JERSEY

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This report calculates the full cost of providing well-planned, high quality pre-school for children in New Jersey, as required under *Abbott vs. Burke* (153 NJ 480 1998).

The benefits of pre-school

The case for investments in pre-school is strong. High-quality pre-school helps children's cognitive growth and the benefits are stronger for children from less advantaged backgrounds. New evidence on the benefits for children from participating in the Abbott district pre-school programs shows that children who attend these programs obtain higher scores in language, literacy, and mathematics. These gains persisted into kindergarten such that children who attended pre-school for two years had closed over half of the gap against national averages for vocabulary. Importantly, investments in pre-school and investments in high quality K–12 schooling are complementary. One does not substitute for the other and the gains from pre-school need to be reinforced through effective elementary and secondary school education.

State investments should reflect this consensus, such that well-planned and high-quality programs are made available, particularly for disadvantaged children or those in low-income families. However, current state expenditures may not fully equate to the amount needed for high quality pre-school.

Pre-school in the Abbott districts

Across the New Jersey Abbott districts, the main component of the pre-school program is six hours of provision for 180 days; the program requirements are high, including small classes and qualified teachers. In addition, the program includes extended day child care and summer provision for 10 hours per day.

Overall, the Abbott district pre-school requirements reflect the research consensus on the components of high-quality pre-school. From a resource perspective, the most important regulations pertain to staffing and class size: certified teachers and master teachers (who mentor and train classroom teachers) are expensive, as is the need for class sizes of 15. There are also significant supplemental services, as well as managerial and accountability resource requirements. The last item is important for ensuring that programs are implemented faithfully. The program is delivered through the public education system. It is a public program, funded and regulated by the Department of Education. Abbott pre-school programs may be offered by private providers, who contract with the school district, as well as through the public school system. In total, there are approximately 600 separate centers or providers. Head Start programs are also available for pre-school children in New Jersey Abbott districts. These Head Start providers may offer 'Enhanced Head Start' which must meet Abbott pre-school standards so as to be eligible for state funding.

Across the 31 districts, 38,900 children are enrolled in pre-school (approximately 75% of the cohort). Over half of all children are enrolled at private centers, with one-third in public school programs, and the remainder in Enhanced Head Start programs and independent special education centers.

Current expenditures on pre-school

Funding for Abbott pre-school comes from two agencies: the Department of Education (DOE) and the Department of Human Services (DHS). The DOE funds the 6-hour educational component of the day and the DHS funds the wrap-around extended day and summer care.

The DOE's estimate of its total expenditures in 2006–07 is $501 million with DHS spending an additional $222 million. DOE funds are allocated to districts. These funds are then allocated to in-district programs, private providers or Head Start centers. Districts do hold back funds to provide district-wide services and administration for the regular pre-school program.

In 2006, per-child state aid for the main component of the program was: $12,585 for children in private centers; $10,900 for children in public programs; and $7,241 for children in Enhanced Head Start. Providers face different costs for teacher hiring, location, and for facilities; private providers may face higher administrative costs because they cannot share facilities with public K–12 schools; and Head Start providers receive federal subsidies to supplement this state aid.

These amounts are high relative to spending in other states. However, the prices of educational services in New Jersey are almost 25% higher than the national average. The adjustment makes a big difference. For example, absolute pay for new teachers in New Jersey is the sixth highest in the nation; when we adjust for relative prices it is the seventh lowest.

Importantly, these expenditures only tell us what is spent on pre-school, not what it costs.

Enhancing the quality of pre-school

There are a number of reasons why pre-school funding may be below what is needed.

Compensation for pre-school teachers may need to be increased. This upward pressure reflects several factors. First, the program requires a specific credential and must include professional development. Second, Abbott pre-school teachers in private settings receive less generous benefits than teachers in the public schools. Third, pre-school teachers have less experience than the average teacher because the program is new; as these teachers gain experience the salary structure is such that their pay will increase. Finally, as the program expands, higher wages must be offered to attract more workers.

A second consideration is facilities. The growth of the pre-school program has put pressure on capital, such that current facilities are probably insufficient. In the public system, many schools are very old and were not constructed for the purpose of

educating very young children. In the private sector, capital funding may be limited and many centers lease rather than own their space. Also, support for public-private partnerships to build facilities has been limited. Hence, there is a need for additional funding to build new facilities and upgrade older schools.

There are additional pressures on pre-school budgets.

Systems of accountability must also be included in the costs of pre-school programs. The Abbott requirements include a rigorous set of state inspections (every three years) and self-assessments and validations by the providers (annually). But these are often not explicitly counted in budget statements or are insufficiently costed.

Pre-school provision for children with special educational needs must also be appropriately funded. DOE data shows that the majority of children with special educational needs are in self-contained settings, which may increase costs unnecessarily. However, the absolute proportion of children in special education in pre-school is low (less than 5%), suggesting its incidence is under-diagnosed. More accurate diagnosis, along with screening services such as Recognition and Response, would raise costs.

The scale of the Abbott pre-school program may also put pressure on costs. The Abbott program is genuinely universal and must be fully funded by the state. Universal programs may be more expensive because they have to accommodate students with heterogeneous backgrounds and must serve all students in the locality, including those who would not have otherwise attended and those who require more supports for learning.

Effective pre-school should also be aligned with K–12 schooling. Alignment includes factors such as the physical movement and transportation of children and information exchange across preschool and kindergarten teachers. The costs for alignment are typically not explicit in budgets.

Ensuring efficiency

It is important to ensure that pre-school programs are efficiently provided. The charge of inefficiency is typically made because public enterprises do not have clear goals, are not directly accountable to customers for revenues, and do not have competitors to force them to meet the needs of clients and keep costs low.

However, it is important not to over-emphasize this argument. Efficiency gains should be sought (regardless of the amount of money allocated). But we have to identify inefficiency and find a remedy and this is not easy. A center is not inefficient simply because it spends more than another or seems to spend 'a lot'. The prices of inputs may differ, as may the quality of provision; and public and private providers may serve children with different characteristics. We have already noted above that prices of educational services in New Jersey are some of the highest in the nation.

Also, the evidence on public schools' inefficiency is surprisingly weak and the most common argument for ensuring efficiency is 'competition through market forces'. There is evidence that competition does increase efficiency. But the Abbott pre-school

system is already competitive: there are many small private centers competing with in-district programs to supply a well-defined, uniform service. It is also closely regulated. This is the classical economic definition of an atomistic, competitive market.

Calculating the full costs of pre-school: Methods

We use several methods to predict the full amount of resource needed to provide a well-planned, high quality pre-school program.

Our primary estimates of the costs of pre-school are based on cost function methods using data on Abbott district pre-schools. We estimate the determinants of the average cost of pre-school in private centers and public program separately.

We use data on the costs and quality from inspections of classrooms in 210 private centers and 535 public programs. We correlate the average cost with the observed quality to see whether improvements in quality are associated with higher costs. Our correlations adjust for the prices of teachers in each district and demographic characteristics. This cost function equation tells us how much more it costs to provide high quality pre-school.

To check our results we review all extant cost templates for pre-school. These templates have been produced by researchers across the U.S. for different pre-school programs. They are researchers' best estimates of what pre-school costs. Our search produced 11 different templates which estimated the cost of pre-school. We adjusted these templates to meet the Abbott district requirements and to account for differences in prices in New Jersey.

Calculating the full costs of pre-school: Results

Our cost function estimates show that higher quality programs do cost more and that hiring more experienced pre-school teachers will cost more. We do not find strong evidence that larger centers have lower unit costs.

Our cost function estimates indicate that current funding should be increased by 5.8% for public programs and 6.8% for private centers. This increase in costs would ensure high quality pre-school programs across the districts. The increase reflects only two factors: the cost of improving quality and the cost of paying teachers more to better reflect the necessary amount of compensation.

For the academic year 2007–08, average per-child expenditures for pre-school in the Abbott districts should be $11,993 for public programs and $13,978 for private centers. These amounts account for the necessary increases to ensure quality and year-on-year inflation. Using current funding ratios, we derive unit costs of $8,189 for Enhanced Head Start provision. This cost is calculated as current Enhanced Head Start spending plus the absolute amount extra that we predict for public centers.

Based on the template estimates, we find that the cost of pre-school across all provider types in the Abbott districts is at least $12,300 per child. This is a lower bound because most cost templates only consider operating costs.

Per-Child Costs of Pre-school in Abbott districts
(adjusted to 2007–08 prices)

	Average	Public programs	Private providers
Current spending	$11,982	$11,333	$13,088
Cost to ensure well-planned, high quality pre-school using cost function method	$12,736	$11,993	$13,978
Lower bound estimate using cost templates	$12,276	$11,611	$13,410

Conservative nature of results

These estimates of unit costs for the Abbott districts are almost certainly conservative. They do not take account of possible under-funding of: facilities; programs to align pre-school with K–12 education; accountability systems; and special education.

Other factors will also raise costs. For example, if more three-year olds are enrolled, our estimates of unit costs understate the true resource requirement. Expanding the program to serve more children is likely to further increase costs. Wages would have to go up; and we find little evidence of savings if centers are larger such that economies of scale can be realized.

To indicate the extent to which these figures are understated, we investigated two factors. One is the cost of quality, i.e. what it costs to raise quality. Our estimates are that an additional 2% in funding would be needed for this aspect alone. Alternative, plausible estimates are closer to 5% or 6%. Thus, funding might be increased by an additional 3 or 4 percentage points. The second domain where our results are conservative is for facilities. The above calculations assume no additional facilities costs. If we assume that currently the underinvestment in facilities is the same as that for teachers, we should add another 1 or 1.5 percentage points to the required funding.

Implications for total funding

Total funding may be calculated as the unit cost times the numbers enrolling. If enrollment is expanded by 4% to cover 40,456 children, annual funding for high quality pre-school in the Abbott districts would total $528 million in 2007–08.

Statewide expansion

Pre-school outside of the Abbott districts is publicly funded under the Early Childhood Program Aid (ECPA) program. Currently, ECPA helps fund pre-school provision for 7,270 children in 101 districts across the state. Per child state aid is approximately $4,400 and total state aid is $30 million.

In addition, the Early Launch to Learning Initiative (ELLI) is a small-scale program offering public pre-school to children outside the Abbott districts. Participating school districts are required to blend state aid with other sources of funding, including local revenue, IDEA, Title I, and parental contributions. In 2006, approximately 1,500 children across 28 districts participated. State aid funding was $2.19 million.

Potentially, many more children across New Jersey might benefit from high quality pre-school. Price indices show that the unit costs of a given quality of pre-school are very similar across Abbott districts, across non-Abbott ECPA-funded districts, and across the state as a whole. Therefore, our cost estimates for the Abbott districts may apply to other districts. However, additional state-level administrative costs and set-up costs will be incurred if the program is expanded to other districts.

Conclusion

Given the benefits of pre-school, it is important for the state to invest in high quality programs. Our cost analysis shows that current spending is somewhat—but not grossly—below what is needed. In conclusion, we note two important aspects for the future of the program.

First, the additional increment in investment is not significantly above the rate of inflation. Therefore, making sure that the rate of change of prices is calculated accurately is important to ensure that the program is adequately funded.

Second, it is important to ensure that the workforce is efficiently structured and that future wage increases are anticipated. The Abbott pre-school program has grown rapidly over a short time period. Many pre-school staff (now highly qualified) are new to their positions. Retaining them will be important to ensure program quality but it will also put pressure on costs: many of these teachers may have offers from other schools and districts as the labor market changes; and as these teachers gain more experience their salaries will increase correspondingly. If current trends continue, upward pressures on wages will necessitate additional funding.

1. INTRODUCTION

This report calculates the cost of providing adequate pre-school for children in New Jersey, as required under *Abbott vs. Burke* (153 NJ 480 1998). Pre-schooling is an important component of the state's Constitutional requirement to provide a "thorough and efficient" system of education. We derive reliable, evidence-based estimates of the costs of well-planned and high-quality pre-school. We focus primarily on provision for children residing in the Abbott districts, but we also extrapolate our estimates for the purpose of statewide expansion.

The case for investments in pre-school is strong. High-quality pre-school helps children's cognitive growth.[1] This conclusion is confirmed by evidence from small-scale experiments, welfare reforms, national data, and evaluations of state preschool programs and Head Start.[2] Yet, not all children have access to preschool. Affluent families are more likely to enroll, as are parents with more education. If we include Head Start, African-American children enroll at rates higher than white children; nationally, Hispanic children enroll at relatively low rates in all programs.[3]

The benefits of preschool are stronger for children from less advantaged backgrounds and for Hispanic children.[4] New evidence on the benefits for children from participating in the Abbott district pre-school programs is presented by Frede et al. (2007). Children who attend these programs obtain higher scores in language, literacy, and mathematics. These gains persisted into kindergarten such that children who attended pre-school for two years had closed over half of the gap against national averages for vocabulary.

However, the quality of preschool is highly varied across the U.S. Children in high-income families tend to experience the highest quality preschool. Children in low-income families do typically enroll in better quality programs than those in middle-income families, but this is because they are eligible for means-tested public subsidies such as Head Start. Importantly, investments in pre-school and investments in high quality K–12 schooling are complementary. One does not substitute for the other and the gains from pre-school need to be reinforced through effective elementary and secondary school education.[5]

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1 The evidence is mixed on the effects of early education on behavior. Using national data, Loeb et al. (2005) and Magnuson et al. (2005) find that center-based care negatively effects children's socio-behavior. The reasons, though, are not clear. Colwell et al. (2001) hypothesize the cause is the cumulative amount of time spent in child care; Loeb et al. (2007) find earlier entry age is associated with more negative effects on behavior.

2 On experiments, see Belfield et al. 2006; Reynolds et al. 2002; Campbell and Ramey 1994. On welfare reforms, see Zaslow et al. 2002. National data are in Magnuson et al. 2007. For state results, see Henry et al. 2003; Gormley and Gayer 2005; Barnett et al. 2005. On Head Start, see Love et al. 2002.

3 On socioeconomic status differences, see: O'Brien-Strain et al. 2003; Hofferth et al. 1995; Fuller et al. 2004; Bainbridge et al. 2005; West et al. 1995; Magnuson et al. 2005. On participation differences, see: Liang et al. 2000. In part, Hispanic children may enroll at lower rates because they live in regions where state programs are smaller.

4 On benefits by race, see: Peisner-Feinberg and Buchinal 1997; Loeb et al. 2004; Magnuson et al. 2007; Gormley et al. 2005. On income effects, see: Belsky et al. 1996; Phillips et al. 1994.

5 Research by Magnuson et al. (2007) finds that how pre-schoolers progress into schools makes a difference to the duration of academic gains. Other research has found pre-school impacts to fade out, in part because of low quality K–12 schooling. See also the model generated by Heckman and Cunha (2007).

Through linking differences in the observable characteristics of pre-school programs to children's outcomes, it is possible to identify programs that genuinely are higher quality. Evidence reveals, for example, that teachers with more education and better training tend to provide higher quality preschool as shown by improved children's academic performance. Likewise, programs with lower child to staff ratios are better, as are programs with more intensive learning and longer duration.[6]

This evidence establishes that high-quality pre-school is academically beneficial (especially for disadvantaged children) and that effective programs can be specified. State investments should reflect this consensus, such that well-planned and high-quality programs are made available, particularly for those children in low-income families. However, current state expenditures may not fully equate to the amount needed for high quality pre-school.

Based on the above evidence, and direct analysis of budgetary data in New Jersey, we calculate the costs of high-quality pre-school for the state. The report is structured as follows. First, we describe current pre-school provision in New Jersey. We report on enrollments and current program standards and document current funding levels; we also consider additional requirements that might be included in the Abbott program requirements. Second, we describe the possible methods for estimating costs and how these might apply to the Abbott districts. We also review the existing evidence. In the third section, we calculate our baseline estimates of the costs of pre-school for the Abbott districts. We use two methods: one is the cost function approach; the other is a variant of the evidence-based reform design applied to pre-school rather than K–12 schooling. Using multiple approaches, we can place bounds on the unit costs. Fourth, we report our estimates of the per child cost of pre-school aggregated up to the district and state level. We focus on provision in the Abbott districts, but also consider the costs of expanding similar services to other districts. Finally, we consider important economic issues related to pre-school provision and expansion across New Jersey.

Our analysis is based on current patterns of enrollment and expenditures. These figures involve thousands of students and many separate expenditure items. Some measurement error is possible, although such error is as likely to overstate as understate our findings. Also, as with all education systems, pre-school in New Jersey is evolving and student mobility—particularly among disadvantaged groups—is high. As such, a fixed picture of pre-school is not easily depicted. Our analysis is based on the best available data at the current time and our calculations are expressed as average costs of provision or marginal costs of expansion; these costs are not heavily dependent on the baseline numbers. Finally, we include sensitivity tests to see how costs vary under alternative assumptions.

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6 On quality, see: Peisner-Feinberg and Buchinal 1997. On teacher quality, see: Loeb et al. 2004; NICHD 2000; Arnett 1989; Fuller et al. 2006; Howes 1997; Blau 2003; Gormley and Philips 2007. On child-staff ratios, see: Clarke-Stewart and Allhusen 2005; Ruopp et al. 1979; Howes et al. 1998. On intensive learning, see: Robin et al. 2006; Fuller et al. 2004. However, programs with stricter regulations are not necessarily better, see: Kisker et al. 1991; Helburn 1995; Gormley 2007.

We do not consider broader policy issues in relation to the organization of schooling in the Abbott districts. These considerations are beyond the scope of this analysis.

Throughout this report money values are expressed in 2007 dollars (unless explicitly stated otherwise). Costs and prices are weighted according to a district-specific or state-specific price index (CWI) generated by Taylor and Fowler (2006). We note here that, as prior indices have shown, New Jersey has one of the highest cost-of-education values of any state: prices of educational inputs are 24.4% higher than the average for the nation. In fact, the CWI is likely to understate the differences in costs when applied to pre-school education and for the most disadvantaged districts. First, it "does not capture any variations in cost attributable to working conditions in specific districts" (Taylor and Fowler 2007, p.4). Second, the CWI does not include workers without degrees or those who work less than half-time "because they are not directly comparable with teachers" (p.7). These understatements mean that our cost estimates are probably conservative.

2. PRE-SCHOOL PROGRAMS IN NEW JERSEY

2.1 Pre-School in the Abbott Districts

The Abbott districts provide pre-school for 3 and 4 year olds following the New Jersey Supreme Court's ruling and codified in the state Department of Education program guidelines. These stipulations are given in Box 1. The specific inputs that correspond to these requirements are given in Appendix Table A1.

Overall, these requirements reflect the research consensus on the components of high-quality pre-school. From a resource perspective, the most important regulations pertain to staffing and class size: certified teachers and master teachers (who mentor and train classroom teachers) are expensive, as is the need for class sizes of 15. There are also significant supplemental services, as well as managerial and accountability resource requirements. The last item is important for ensuring that programs are implemented faithfully.

As part of the comprehensive full-day, year-round pre-school provision in Abbott districts, wraparound childcare services are offered beyond the six hours of education programming.[7] These wraparound services consist of 4 hours per day during the school year and 10 hours per day during the 65-day summer session. The Abbott programs therefore have three components: a regular pre-school program; extended-day wraparound provision; and summer wraparound provision.

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7 Until July 2007 all families were eligible for extended day coverage at no charge. After July 2007 families with incomes greater than 300% of the federal poverty line must pay the full cost of these wraparound services.

Box 1
Pre-school program standards: Abbott districts

Duration	For 180+ days (the length of the district's K–12 school year), 6 hours educational component + 4 hours wraparound services For additional 65 days, 10 hours of wraparound services
Child eligibility	All 3 and 4 year olds living in the Abbott district Districts must plan to enroll at least 90% eligible students in district.
Eligible providers	District centers; district-contracted community private centers; and Head Start programs that meet Abbott standards
Class size	Maximum at 15
Staffing per classroom	1 Certified teacher (BA + P–3 certification) 1 assistant teacher
Other staff	1+ master teacher per 20 classrooms 1 on-site director 1+ social worker per 250–300 preschool students 1 preschool intervention team per 750 children
Supplemental services	Social services, health, transportation
Students with special needs	Programs must serve ESL and disabled students
Mandated curriculum	Developmentally appropriate curriculum that meets content standards
Assessment	NJ Early Learning Assessment System (mandatory)
Monitoring and accountability	"Validation visit" by state once every 3 years. Annual internal assessment by providers.
Facilities	New facilities must be 950sqft, no higher than the 2nd floor, with outdoor spaces, natural light, and storage space
Professional development	As per K–12 schools.

Source: NJ Administrative Code Title 6A, Chapter 10A. www.state.nj.us/njded/code/current/title6a/chap10a.pdf

The Abbott pre-school program is delivered through the public school system. It is a public program funded and regulated by the Department of Education. Abbott pre-school programs may be offered by private providers, who contract with the school district, as well as through the public school system. In total, there are approximately 600 separate centers or providers. Head Start programs are also available for pre-school children in New Jersey Abbott districts. These Head Start providers may offer 'Enhanced Head Start' which must meet Abbott pre-school standards so as to be eligible for state funding.

Table 1 shows the enrollments in pre-school in the Abbott districts. Across the 31 districts, approximately 75% of eligible children are being served. Of these 38,900 children, 55% are in private centers and 35% are 'in-district', i.e. in public schools. Of the remainder, 8% are in Enhanced Head Start programs and 3% in independent "self-contained pre-school disabled class rooms".

Table 1
Demographic Information on Pre-school in the Abbott districts (2006–2007)

	Abbott school districts
Number of districts	31
Percent of eligible children in publicly-funded pre-school	~75%
Actual enrollment in publicly-funded pre-school	38,900
Private providers	55%
In-district providers	35%
Head Start (enhanced)	8%
Special education (self-contained)	3%
Three-year olds	45%
Four-year olds	55%

Sources: NJ DOE Office of Early Childhood Education. www.state.nj.us/education/data/.
Notes: Data retrieved August 5 2007, prior to final authorization by the state.

Across the 31 Abbott districts there is variation in what proportion of children living in the district are served, which settings they are in, and in how many three-year olds participate. Full details for the 2006 cohort are given in Appendix Tables A2 and A3. Districts vary from only two-thirds participation to practically complete enrollment (population numbers are predictions and potentially mis-state participation rates). Some districts elect not to contract out pre-school services through community-based private providers, other districts have no Enhanced Head Start places, and one district has no public provision.[8] Although three-year old children are participating at high rates, there are still some districts where they are significantly under-represented (e.g., Camden).

2.2 Abbott pre-school expenditures in New Jersey

Funding for Abbott pre-school comes from two agencies: the Department of Education (DOE) and the Department of Human Services (DHS). The DOE funds the 6-hour educational component of the day (the 'regular program'). The DHS funds the wrap-around extended day and summer care.[9]

The DOE's estimate of its total expenditures in 2006–07 is $501 million, and based on the DOE's enrollment figures, DHS expended an additional $199 million.[10] DOE Funds are allocated to districts. These funds are then allocated to in-district programs, private providers or Head Start centers. Districts do hold back funds to provide district-wide services and administration for the regular pre-school program. Centers

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8 Hoboken has pre-school in public schools that are operated by private providers.

9 The focus here is on the amounts spent, not the sources of funding. Ritter and Lauver (2003) analyze the sources of funding and disparate burdens across local communities in New Jersey. We recognize that funding is blended from a range of sources (e.g., Abbott pre-school expansion aid and ECPA aid to Abbott districts).

10 These figures are approximate since neither DOE nor DHS has final reconciled numbers for the 2006–2007 year. DHS calculates actual expenditures from retroactive monthly attendance counts provided to DHS by pre-school providers. The DOE initially tabulates enrollment from projected enrollment figures provided by 31 Abbott districts, with final reconciliation at the end of the year. The two methodologies for enrollment yield disparate enrollment figures. For this report, the authors estimated DHS expenditures by multiplying the DOE enrollment count of 38,900 by the DHS per pupil allocation for wrap around services.

differ in the budgets per child: on average, in-district centers receive allocations of $10,987; private providers, $12,585; and Head Start providers $7,241. (These figures include provision for children with special educational needs. The Head Start resources do not count federal transfers).

For wraparound services, DHS provides funds to all the providers at a per-child monthly unit rate. The calendar year 2007 rate for accredited pre-schools is $394 per month for the half-day services (4-hours per day for 10 months) and $587 per month for full-day services during the two summer months. Assuming a child attends wraparound services for the full year, the annual funding for these services is $5,110.

Table 2 shows the trend in regular expenditures in the Abbott districts since 2002. By 2006 enrollments have stabilized at 38,900 (although there is still some local unmet demand with children on waiting lists). Similarly, per-pupil DOE expenditures are stable at approximately $11,500 in real dollars. Table 3 reports expenditures per-child by center type in each of the Abbott districts. Expenditures in private centers are higher than in public settings, by $1,687 or 15%. There may be many reasons for this difference, such as the need to find facilities, the types of students that are served by private providers, or the locations of centers. Public centers may be able to piggyback on school resources such that some of their costs are hidden. Notably, private providers serve a large proportion of children; without them, the number of available places would be much lower.

The range of spending across private centers is also significant, from $10,149 to $15,341; funding differences across public programs are also substantial. The bulk of this disparity in funding levels may be attributable to variation in teacher qualifications: the DOE salary schedules remunerate centers at higher rates for teachers with more years of experience, academic credentials, or state certification. So a pre-school that hires more experienced staff will be reimbursed more.

Note, however, that these expenditures only tell us what is spent on pre-school, not what it costs.

Table 2
Expenditure information for the Abbott districts 2002-2006

Academic year	Total annual expenditures ($ millions)	Average spending per child	
		Nominal dollars	2007 dollars
2002	$379.92	$9,645	$11,092
2003	$406.33	$9,637	$10,697
2004	$451.82	$10,519	$11,466
2005	$463.93	$10,754	$11,292
2006	$460.00	$11,521	$11,752

Sources: NJ DOE. www.state.nj.us/education/data/. Total annual spending in nominal dollars. Spending does not include DHS funding. Enrollment in 2006 is actual, not approved.

Table 3
State Expenditures

	In-district	Private provider	Head Start
Asbury Park	$8,113	$15,341	$7,544
Bridgeton	$10,528	$10,780	$4,028
Burlington City	$9,269	$10,518	–
Camden	$8,698	$11,161	$3,666
East Orange	$9,902	$11,196	$7,550
Elizabeth	$13,364	$15,305	–
Garfield	$10,884	$10,724	–
Gloucester	$11,098	–	–
Harrison	$11,712	$13,407	–
Hoboken	–	$11,906	$10,076
Irvington	$11,911	$13,043	$6,945
Jersey City	$11,262	$12,837	$5,413
Keansburg	$10,315	–	–
Long Branch	$9,014	–	–
Millville	$9,817	$10,904	$4,654
Neptune	$10,120	$13,273	–
New Brunswick	$8,346	$12,719	$3,354
Newark	$9,194	$13,785	$8,026
Orange	$8,931	$12,318	$6,784
Passaic	$12,294	$13,703	$6,157
Paterson	$7,793	$11,989	$7,035
Pemberton	$9,109	$11,766	–
Perth Amboy	$12,898	$12,299	–
Phillipsburg	$10,516	$12,586	$8,457
Plainfield	$7,532	$12,102	$6,309
Pleasantville	$10,547	$12,287	$5,309
Salem	$10,524	–	$7,407
Trenton	$10,666	$13,054	–
Union City	$9,992	$10,149	$7,499
Vineland	$10,712	$12,768	$6,403
West New York	$10,684	$12,881	$7,130
WEIGHTED AVERAGE	**$10,900**	**$12,585**	**$7,241**

Source: New Jersey Department of Education (OPRA submission).
Notes: Missing cells denote no provision or information not available. Costs included pro-rated shares of district-wide administrative costs for pre-school. Spending does not include DHS funding for wraparound services. Weighted average accounts for district enrollment patterns.

2.3 Pre-school outside the Abbott districts

Pre-school outside of the Abbott districts is publicly funded under the Early Child-hood Program Aid (ECPA) program. Full details of the program are in Box 2. State funds are available for districts if 20%–40% of the students are from low-income families. Currently, non-Abbott ECPA helps fund pre-school provision for 7,270 children in 101 districts across the state. Per child state aid is approximately $4,400 and is allocated based on K–12 enrollment. Total state aid is therefore $30 million. However, state funding may be supplemented from other local and federal sources.

In addition, the Early Launch to Learning Initiative (ELLI) is a small-scale program offering public pre-school to children outside the Abbott districts (but including other ECPA districts). Participating school districts are required to blend state aid with other sources of funding, including local revenue, IDEA, Title I, and parental con-tributions. In 2006, approximately 1,500 children (600 of whom were low-income) across 28 districts participated. State aid funding was $2.19 million.[11]

Box 2
ECPA pre-school program standards: ECPA non-Abbott districts

Duration	Minimum of 2.5 hours/day for academic year. Half-day program comprises 75% enrollees, and full-day program for the remaining 25% of enrollees
Child eligibility	4 and 5 year olds. (3 year olds if funds permit) High poverty districts (At least 20–40% of children enrolled in district qualify for the federally-subsidized Free Meals or whose families earn 130% of the poverty level)
Eligible providers	Primarily district-provided (89% enrollees), although community-based contracting allowed
Class size	ratio of 1:25
Staffing per classroom	Teachers must have BA and be certified in early childhood
Support staff	No requirements
Supplemental services	Recommended to include health, nutrition, and "other" services. Districts should address transportation barriers.
Students with special needs	District should try to mainstream IEP students
Mandated curriculum	5 recommended curricula
Assessment	No mandated assessment
Professional development	Each district must submit a professional development plan in their 1-year operational plan.
Inspection	District must certify that programs meet quality standard. 7-year monitoring cycle by state.

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11 The regulations for ECPA and ELLI provision are much less stringent and detailed than those for Abbott (e.g. the latter has smaller classes and higher staff-child ratios). Thus, processes across these three program types are not easily compared.

Finally, many families across New Jersey will enroll independently in private programs. Nationally, one-third of all four-year-old children are enrolled in private programs (Blau and Currie 2006).

2.4 Evaluating the Abbott program requirements

Relative to many other states' programs, the Abbott program requirements are high. Absolute public spending in New Jersey on early education per child Abbott pre-school is also higher than almost all other states (unadjusted for CWI). In part this reflects the unusually extensive set of Abbott pre-school services when compared to other states. It does not imply that the Abbott program is sufficiently well-resourced or that the standards are sufficiently high (given the research on the benefits of pre-school). So, although the Abbott program requirements broadly meet quality standards, there remain a number of issues relating to the quality of the programs currently provided.

We consider a range of factors that may cause a divergence between current expenditures and what it actually costs to offer well-planned, high quality pre-school in New Jersey. The goal is to see whether pre-school programs are under-funded or over-funded.

Teacher Quality

The first issue for high-quality preschools is to ensure that all teachers are qualified (Early et al. 2007). National Institute for Early Education Research (NIEER) quality ratings emphasize teacher quality, such that: the lead teacher must have at least a BA, have specialized training, and perform annual in-service training of at least 15 hours; and the assistant teacher must have a Child Development Associate (CDA).[12] As of 2006–07, over 99% of Abbott pre-school teachers have at least a BA degree and 43% have a P–3 certification.

However, in the early years of the Abbott program, finding adequately credentialed teachers was a challenge.[13] Many pre-school lead teachers have recently obtained certification.[14] But, the preschool labor market and career routes are not as sharply established as for K–12 teachers. Pre-school certification programs may be less valuable or more risky if they do not transfer across labor markets (e.g., to other states where pre-school teachers do not require degrees). Also, the most recent NIEER *Yearbook* (2006) shows the Abbott district standards only miss one of the ten quality benchmarks: the expectation that assistant teachers have a CDA credential.

A second concern is that pre-school teachers are relatively inexperienced. Abbott district pre-school teachers have on average 5.6 years of experience, compared to a national

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12 Similarly, NACCRRA (2007) quality standards expect teachers to have a CDA credential or Associate's degree in early education; annual training, including health and safety; and center directors must have at least a BA. We note here that neither of these frameworks considers second language competency for pre-school teachers.

13 Early survey data showed that New Jersey teachers tended to be academically qualified—the proportion of teachers with only high school or an Associate's degree as their highest qualification was relatively low in New Jersey (13% in the Abbott districts but 27% nationally)—but the proportion of teachers with Child Development Associate credentials was only 15% in the Abbott districts compared to 23% nationally (Gilliam and Marchessault 2005).

14 Certification has been very recent: as of 2004, over 80% of teachers in the Abbott districts were working toward a P–3 credential (Ryan and Ackerman 2004).

norm of 8.2 years. Two-fifths of teachers have less than five years experience (Ryan and Ackerman 2004). Inexperienced teachers are paid less, but experience is also positively correlated with educational outcomes such that program quality is sacrificed.

A third concern is professional development (Odden et al. 2002). The Abbott requirements mandate that districts provide at least one master teacher per 20 Abbott preschool classrooms in the district who may perform on-the-job training. But Abbott pre-school teachers report less time than their peers for individual and team planning: per week, the hours on these tasks are 3.3 and 1.5 in the Abbott districts, but 4.1 and 2.2 nationally. Moreover, across New Jersey pre-school teachers may have followed a less traditional career path; they may be older than K–12 teachers and less likely to be in full-time employment (Ryan and Ackerman 2004). Therefore, their training needs may be greater.

Each of these factors is likely either to put upward pressure on salaries or to mean that pre-schools hire from a less-qualified or inexperienced labor market. Abbott pre-school teachers in private settings are paid on the same scale as public school teachers, but their health and retirement benefits are not as generous (because they are more expensive to purchase). So there are two effects: one is the relative position of pre-school teachers to school teachers in the Abbott districts; the other is the relative position of teaching in the Abbott districts to other occupations or teaching in other districts.

Unfortunately, wage comparisons must account for the many different circumstances across labor markets (Stoddard 2005). In absolute money amounts, pre-school teachers in New Jersey receive compensation that is comparable to—and often higher than—national norms. In New Jersey and across the U.S., hourly wages are $24–$30 and annual salaries average $40,000; and the majority of teachers receive health and retirement benefits (see Appendix Table A4). Critically, price index adjustments make a big difference: Taylor and Fowler (2006, p.15) note that, although the unadjusted salaries for beginning teachers are relatively high in New Jersey, "Adjusted for geographic variations in hiring costs, beginning teacher salaries in New Jersey were not the sixth highest in the nation, but instead the seventh lowest." As pre-school salaries are set in correspondence to K–12 teachers, this adjustment also applies to pre-school. Regardless of national comparability, however, requiring more credentials of teachers and finding more experienced teachers will necessitate higher pay.

Facilities

Abbott pre-school program enrollments have grown substantially over a very short period of time (see Table 2). Plus, the Abbott requirements of 950 square feet per classroom exceed the minimum space in pre-school designs (of 35 sqft per child, Sussman 2005; Butin 2000). This requirement puts pressure both on existing providers and on new centers. In their study for Pennsylvania, Gill et al. (2002) report that start-up costs are a substantial constraint on new centers.

Across the Abbott districts, resources for facilities and capital construction are probably insufficient. In the public system, many schools are very old and were not constructed for the purpose of educating very young children. In the private sector, capital funding may be limited (Fuller and Wright 2007, p21) and over two-thirds of centers lease rather than own their space (Rice and Ponessa 2004). Leased spaces may not

have been designed for the purpose of providing pre-school. Also, support for public-private partnerships to build facilities has been limited. Hence, there is a need for additional funding to build new facilities and upgrade older schools.

Additional Cost Considerations

We identify a number of additional cost considerations. Most of these are likely to raise the pressure on pre-school resources.

Systems of accountability must also be included in the costs of pre-school programs. Quality rating scales emphasize these systems.[15] But they are often not explicitly counted in budget statements or are insufficiently costed (as shown in the literature review below). The Abbott requirements include a rigorous set of state inspections (every three years) and self-assessments and validations by the providers (annually). Across all district-wide services, it is unclear whether these internal and external accountability systems are being fully allocated to pre-schools (Applewhite and Hirsch 2003).

Pre-school provision for children with special educational needs must also be appropriately funded. Special education programs are on average 1.9 times more costly than regular education programs (Chambers et al. 2003). DOE data shows that the majority of children with special educational needs are in self-contained settings (contrary to the frequency in K–12 education). These settings are normally more expensive than inclusive settings. Therefore, if there is over-classification into self-contained settings, then the state is over-paying for special educational services in pre-school.[16] However, the absolute proportion of children in special education in pre-school is low (less than 5%), suggesting that the incidence of special education is under-diagnosed. More accurate diagnosis, along with screening services such as Recognition and Response, would raise costs. In addition, very few children with special educational needs are in private centers. In part this may reflect expertise and training within the public sector.[17] But it also reflects the weaker incentive for private providers (and these cannot typically cross-subsidize such provision).

The scale of the Abbott pre-school program may also put pressure on costs. Unlike programs in other states, the Abbott program is genuinely universal (not targeted) and must be fully funded by the state. Universal programs may be more expensive in that they have to accommodate students with heterogeneous backgrounds and serve all students in the locality. Universal programs must also cater to students who would not have otherwise attended pre-school and who may require more supports for learning. (These costs may be offset by reduced administrative costs for determining eligibility). Typically, state funding for pre-school is not the only source of funding (with federal and local governments often contributing).

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15 NIEER ratings account for whether regulatory agencies make site visits to ensure compliance with requirements. NACCRRA ratings expect: centers to be licensed and to be inspected at least 4 times per year; licensing staff to have at least a BA and a center caseload of fewer than 50 programs; and inspection reports to be publicly available.

16 In 2007 75% of preschool children with disabilities statewide and 60% in the Abbott districts are in segregated settings (www.nj.gov/education/specialed/info/spp/partb.doc).

17 Communication, Ellen Frede.

Effective pre-school should also be aligned with K–12 schooling. Alignment includes factors such as: the physical movement and transportation of children; parental preparation for school; information exchange across preschool and kindergarten teachers; and staff collaboration. Using national survey data, Magnuson et al. (2007) find that children progress faster when the transition to public elementary school is easier. Yet, in a recent study of the Abbott districts, Rice (2007) finds that alignment in each of these factors is not adequate. However, absent information on the costs of improved alignment, we do not include this factor in our cost calculations.

Finally, the cost of pre-school might be below current expenditures if there is substantial inefficiency in provision. The claim of inefficiency is typically made because public enterprises do not have clear goals, are not directly accountable to customers for revenues, and do not have competitors to force them to meet the needs of clients and keep costs low. However, it is important not to over-emphasize this argument.

Certainly, efficiency gains should still be sought, regardless of the amount of funding allocated. But we have to identify inefficiency and find a remedy. This is not easy. A center is not inefficient simply because it spends more than another. The prices of inputs may differ, as may the quality of provision; public and private providers may serve children with different characteristics; and in less densely populated areas fewer children may enroll or transport costs may be higher. For the last example, a remedy is not feasible (unless families are forced to move closer together).

In fact, the evidence on public schools' inefficiency is surprisingly weak and the most common argument for ensuring efficiency is 'competition through market forces'. The evidence on competitive pressures raising quality and efficiency of education is reasonably strong; there is even evidence for pre-school (Henry and Gordon 2006). But the Abbott pre-school system is already competitive: there are many small private centers competing with in-district programs to supply a well-defined, uniform service. This is the classical economic definition of an atomistic, competitive market.

Expenditures and Costs

Overall, these factors suggest that current budgets are below what is necessary to offer well-planned and high quality pre-school in the Abbott districts. Below we calculate the full (predicted) costs to meet the program requirements and satisfy the New Jersey Supreme Court mandated standards.

3. COSTING OUT PRE-SCHOOL: METHODS AND EVIDENCE

3.1 Methodology

The purpose of this costing out study is to calculate the cost (or minimum amount of resources) needed to achieve a specific level of child development through pre-school (Levin and Schwartz 2007). In this case, the specific pre-school program is one that meets the Abbott requirements.

It is important to clearly define the pre-school program, particularly in relation to other costing out exercises. For the Abbott districts, we distinguish between the costs

of: (a) the regular pre-school program (6 hours over 180 days); (b) the regular program with wraparound services at the end of each day (item (a) plus 4 hours of childcare over 180 days); and (c) the total costs of the full program (item (b) plus 10 hours of childcare over 65 days in the summer). Typically, child care programs are less costly than pre-school programs: the former typically hire staff at lower pay rates, place less emphasis on early childhood instruction, and are less likely to be sited in a public school (Blau and Currie 2006). Overall, these childcare programs have less stringent standards. Therefore, we calculate childcare costs and pre-school costs separately.

There are four possible approaches to costing out pre-school: the professional judgment (resource cost) model; the successful district model; the evidence-based reform design; and the cost function estimation (Downes and Stiefel 2007). In the professional judgment model, a group of experts convenes to establish a prototype education, listing the elements needed such as staff, instructional time, curriculum content, administrative overheads to achieve that education. These elements are then costed out. In the successful district model, the approach is to identify schools or districts that are already providing the prototype education and then calculate the inputs required to achieve the same results for other students. The evidence-based reform design starts with a specific reform (e.g., Perry preschool model) and then identifies the costs associated with the inputs required for that reform. Finally, the cost function estimation method uses performance measures (e.g., preschool quality ratings) and current cost data to determine how much a given school would need to spend to obtain a given rating, taking into account the characteristics of the school and students. Here, we apply the last two approaches to calculate a baseline amount of funding per child in pre-school. We then calibrate these baseline figures to account for variations in district characteristics and demography.

We forego the professional judgment model (PJM), which is the most popular method.[18] PJMs conducted for similar settings have yielded large variations in costs (Downes and Stiefel 2007). To some degree, the PJM model might overlap with the evidence-based school reform design because the inputs required for successful pre-school are well-specified in several pre-school interventions. Indeed, if the experts involved in the PJM panels are provided with the research evidence, then such evidence might be determinative for pre-school, i.e. the research dictates which inputs are needed. More importantly, the inputs required for pre-school in this case are set down in the Abbott rulings.[19]

Essentially, all these costing out methods assume that: (a) current expenditures are somewhat reflective of need; (b) providers are in some sense maximizing educational outcomes given the resources available to them; and (c) a failure to satisfy quality standards is primarily a consequence of inadequate funding (Baker 2005). These assumptions seem *prima facie* plausible and they are implicit in our costing out exercises.

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18 PJMs have been performed primarily in K–12 settings. Examples include: Augenblick and Myers 2002; Augenblick and Silverstein 2003; and Odden et al. 2006. All of these examples focus on K–12 education.

19 Alternatively, without this research evidence, the experts may fail to reach a consensus: because the Abbott preschool programs are relatively recent and there is not a well-developed history of student-level assessments the professionals may not agree on how to relate pre-school inputs to outcomes.

Nevertheless, these methods have been criticized. Hanushek (2006) claims that: (a) there is no evidence that more resources will lead to better outcomes; (b) systemic reforms should be applied before committing further public funding; and (c) inputs are purposefully chosen with the goal of increasing expenditures. Each of these contentions has significantly less merit when applied to investments in pre-school for the following reasons.

First, there is a good understanding of the best inputs to use, as well as the purposes and outcomes from pre-school (see the footnotes in the Introduction above). The correlation between cost and quality is shown in Currie and Neidell's (2007) study of Head Start. But leaving aside the well-documented achievement gains for children, there is research showing how: screening reduces subsequent health problems; how parental engagement improves school-family relations; and how recognition and response programs ameliorate placement in special education. Without resources for screening, parental engagement, and recognition and response programs, these benefits cannot be realized.

Second, all public service providers may have an incentive to 'over-identify' need, so that more funding is made available. However, in the case of pre-school where a sizeable portion of services is provided through the private sector, this distortion may be less significant. In New Jersey, as in other states, there are private providers of pre-school, such that competition between providers will discourage them from inflating needs (see Henry and Gordon 2006). Also, there are many instruments to evaluate and monitor pre-school programs, such that genuine need can be determined.

Third, this costing out model is based on the Abbott requirements, which predetermine the inputs rather than allowing providers to allocate inputs in ways that purposefully increase expenditures. This costing out exercise involves pricing out these prescriptions under the assumption that they are implemented faithfully.

Certainly, the disadvantages of the cost function approach are that it treats the delivery of education as a 'black box', i.e. it does not consider the process of education such as modes of instruction or curriculum content. It assumes that centers are minimizing costs and use all types of input. It also assumes that all inputs can be varied and that any differences in inputs are reflected in their prices (see Blau and Mocan 2002; Gronberg et al. 2004).

But a key advantage to the cost function approach is that we can use information on the many individual pre-school providers; we do not solely rely on district-level relationships which cannot identify cost consequences attributable to within-district heterogeneity. Moreover, in applying more than one method and relying on many independent sources, we can provide a more objective estimate of costs. These separate approaches amount to a series of sensitivity tests that should make the costs estimates more reliable (as advocated by Duncombe 2006).

3.2 Prior evidence

Thus far, the four costing out methods have not been extensively applied to calculate an adequacy standard for pre-school. A state-level adequacy study that addresses the costs of pre-school in Kentucky was undertaken by Lawrence O. Picus & Associates (2003a) but this study focuses primarily on K–12 schooling. It does not include a full costing out model for pre-school. In their study for Arkansas, Lawrence O. Picus & Associates (2003b) recommend expenditures of $100 million to expand the existing ABC program by 22,300 places. However, this program is only 36 weeks per year, with class size of 20.[20] Notwithstanding, there is a substantial body of related research using econometric methods and school reform costing templates.

Several econometric studies derive cost functions for childcare centers (not pre-schools). Using data on 266 childcare centers from the Cost, Quality and Outcomes study, Blau and Mocan (2002) estimate a cost function; parallel research was performed by Mukherjee and Witte (1993) and Mocan (1997). Powell and Cosgrove (1992) estimate a cost function for 206 children care centers across the U.S. Helburn et al. (2002) use data from 116 pre-school age day care centers in California, North Carolina, and Texas. Zellman and Gates (2002) do so using data from 59 childcare centers across the U.S. military services.[21] Many of the findings from these studies, discussed below, are quite plausible and may apply to pre-school.

Total costs are affected by the prices of inputs (Blau and Mocan 2002). However, the relationship differs depending on whether the center is non-profit (NP) or for-profit (FP). As wages go up by 10%, total cost increases by 3% (NP) or 8% (FP). As the prices of materials go up by 10%, total cost increases by 2% (NP and FP). As the price of capital goes up by 10%, total cost increases by 0% (NP) or 2% (FP). This last finding is unsurprising: non-profits often rely on donated or cross-subsidized space, such that when the price increases their costs are not significantly affected.

Total costs are also affected by the scale of the center. Larger centers are associated with lower unit costs, i.e. there appear to be economies of scale. But the effect is not dramatic. As the total hours of pre-school offered by a center goes up 10%, total costs go up by 8–9% (Mocan 1997; Powell and Cosgrove 1992). Evidence collected using other methods also suggests that economies of scale are not large.[22]

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20 For Connecticut, Augenblick et al. (2005) used a professional judgement panel approach to determine spending for a program which would add on average $650 per student (applied to all students enrolled in a district regardless of student age) for small districts, $813 per student in moderate districts, $1,144/student in large K–12 districts, and $746 per child in K–6/8 school districts.

21 However, the cost function specification is linear and the control variables are of limited pertinence for New Jersey.

22 In other states the pre-school market is not highly concentrated. After over a decade of free entry into the pre-school market in Georgia the median provider offers pre-school programs at only two sites (Levin and Schwartz, 2007). In other states, no large enterprise has taken over the market. This revealed behavior suggests that diseconomies of scale do occur; possibly, these are managerial diseconomies in operating multiple sites. Golin et al. (2003) estimate that unit costs will be virtually unchanged as a program expands from 60% participation to 80% participation (unit costs might differ by 0.2%).

For-profit centers report lower costs per child (unadjusted for quality). Powell and Cosgrove (1992) estimate that private centers have costs that are 9% lower than public ones.[23] This difference is reflected in wage payments: non-profits pay 9–18% more than for-profits; overall, they spend 78% of their budget on staff, compared to 62% by the for-profits (Helburn 1995). Centers that are either Head Start or enroll children with special educational needs have variable costs that are 25% higher (Blau and Mocan 2002).

Pre-school programs for three-year olds are more expensive than for four-year olds (Powell and Cosgrove 1992). Younger children typically need more supervision, which means smaller class sizes. Zellman and Gates (2002) report that the costs for toddlers are 32% higher than for pre-school aged children and 90% higher than for school-age children.[24]

The important relationship for public policy is the one between funding amounts and the quality of the program (Hanushek 2006). Blau and Mocan (2002) calculate that in order to score one-unit higher on the Early Childhood Environment Rating Scale–Revised (ECERS-R), total costs must be 5.6% higher. The other studies use quality measures that are less ideal than the ECERS-R ratings, but they too find a positive association between costs and outcomes.[25]

Our analysis for the evidence-based school reform approach draws on two separate lines of research.

First, there are programs that have been identified as effective using high quality research methods. These programs include the Perry High/Scope Program and the Chicago Child-Parent Center Program. The ingredients in these programs are known and they can be priced out for the New Jersey Abbott districts.

Second, there are a number of costing templates for pre-school.[26] These templates follow a similar protocol of: determining enrollment; identifying quality measures such as class size, teacher qualifications, and curriculum content; calculating baseline costs; calculating upgrade costs; and modeling program expansion. However, these templates are either specific to a state or only set out the most basic cost structures. In the latter case, their actual dollar values are illustrative, rather than calibrated to actual budgets and adjusting for district characteristics and demography. For comparison purposes these templates are included in our evidence-based school reform design analysis.

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23 Zellman and Gates (2002) find that the Department of Defense facilities were more cost-efficient than those run by private providers. Settings matter even for model programs: the Abecedarian program is one-sixth more expensive in a public school center than a child care development center (Masse and Barnett, 2002).

24 Mocan (1997) finds modest evidence of economies of scope, such that it should be lower cost to offer programs for 3-year olds and 4-year olds at the same site.

25 For example, Helburn et al. (2002) find a positive but quite modest association between fees and the Family Day Care Rating Scale. Also, costs are higher if class sizes (a proxy measure of quality) are smaller: an increase in the staff-child ratio of 10% raises costs by 3–5% (Blau and Mocan 2002).

26 See Barnett and Kelley 2002; Barnett and Robin 2006; Golin et al. 2003; and Stebbins and Hanson Longford 2006; Yonce et al. 2006.

4. ESTIMATING THE COSTS OF PRE-SCHOOL

4.1 Cost function method

Data and model specifications

We estimate cost functions for pre-school private centers and public programs separately. As applied to K–12 school districts, the generic specification for cost functions is cost per child as a function of enrollments, input prices, attributes of providers, local demographics, and provider quality (Duncombe 2002).

We merge three datasets to estimate these cost functions. Budgetary data are taken from Department of Education budget statements; we used data for 2006–07 for the private centers but for 2003 through 2007 for the public programs. For the most recent years these are budget statements rather than actual expenditures, but the two are likely to be highly correlated (given the high level of accountability to ensure that providers do spend their allocations). These data include the unit costs for each individual private provider but only district-aggregated unit costs for the public providers. Information on private center and district-level enrollments are also available. To these data we merge information on the quality of the providers. These data are from the Early Learning Improvement Consortium (ELIC) evaluations of classrooms (Frede et al. 2007; Esposito Lamy 2005). The evaluations, which are part of the state accountability system for the Abbott pre-schools, use the ECERS-R scale, which is widely recognized as a valid measure of pre-school quality (Blau and Mocan 2002; Burchinal et al. 2000). Finally, we augment these data with district-specific demographic variables from the Census.[27]

Our specifications are close to the estimation by Blau and Mocan (2002). We estimate the function using ordinary least squares, which has the advantage of being robust.[28] The dependent variable is the log of each center's average per pupil costs for the 6-hour educational portion of the pre-school day lasting an academic year. The independent variables are teacher wages (input prices), provider/district attributes, and local demographic variables. We estimate a log-linear function to account for the distribution of the dependent variable (which is censored at zero). Coefficients on independent variables may therefore be considered as percentage changes in costs. We also include demographic variables as controls for unobserved local heterogeneity. Based on data availability, the specifications for public and private centers differ in terms of provider/district attributes. To ensure a sufficient sample size we pool data across the available years: complete data is available on classrooms in 210 private centers and 535 public

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27 We apply several alternative approaches to estimating a cost function. Each suggests that centers would benefit from additional funding to improve quality. Based on state-level data and quality benchmarks from the NIEER 2006 yearbook, we find that spending is higher for states meeting 8 of the 10 quality benchmarks (Levin and Schwartz 2006). Simple differences are given in Appendix Table A1. (For both items where there is no correlation, the finding is plausible: Early et al. (2006) find that a BA alone is not a strong indicator of program quality).

28 It does not control for the endogenous determination of quality with costs, as modeled by Duncombe (2006) and others. However, Blau and Mocan (2002) report that instrumental variables estimation, a method they used to circumvent the potentially circular relationship between quality and cost, did not affect their results (as does Imazeki 2006).

programs.[29] Frequencies for the variables are reported in Appendix Table A4 for the private centers and Appendix Table A5 for the public programs.

In fact, there are a number of reasons why this estimated relationship between quality and cost is likely to be an understatement. First, if relatively inefficient districts have lower performance and higher spending, then the coefficient on the quality measure will be biased downward (Imazeki 2006). Second, coefficients will be biased downward if there is measurement error or multicollinearity. Third, ECERS-R ratings may not capture all dimensions of the outcomes desired from the program; the inspections might also not precisely identify quality.[30] Finally, the Abbott pre-schools are improving in quality such that it is hard to identify differences in quality.[31] ECERS-R scores include some process measures (e.g. in regard to facilities) such that a center's score is unlikely to go down year-on-year; low quality provision is therefore not fully reflected in the scores.

Cost function estimates

For private centers the cost function is reported in Table 4. This specification explains 52% of the variance in costs. We note several key findings; these indicate that our results correspond well with the existing evidence. First, higher quality pre-schooling costs more: a center would need to spend 2% more to raise its ECERS-R score by one unit, holding all other things constant. This is lower than the 6% found by Blau and Mocan (2002) but our sample is from a more homogeneous set of providers. Second, pre-schools in labor markets where teachers' wages are higher have higher expenditures. This relationship is particularly strong for assistant teacher wages: for lead teachers, increasing wages by $1000 would raise costs by 2%; for assistant teachers, the same increase would raise costs by 14%. Third, the link between costs and scale is weak, suggesting that pre-schools with fewer Abbott classrooms do not necessarily cost more. The coefficient on Abbott-eligible enrollment is not significant, as with the coefficient on whether the center operates multiple sites. However, costs are lower if the private center enrolls any children who are not eligible for Abbott subventions.[32] Thus, larger centers probably do have lower costs, but the savings are not large. Finally, for-profit centers have higher costs.

For public pre-school providers the cost function is reported in Table 5. Again, the dependent variable is the log of the average cost per child in a given academic year for the 6-hour educational portion of the pre-school day for the length of the academic year. These results are broadly similar to those for the private centers reported in Table 4.

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29 The cost function for the public programs is less well-determined than for private providers. Costs are only available at the district level, whereas ECERS-R quality measures are per center (or per classroom). Furthermore, there are only 31 Abbott districts. This motivates our decision to pool the sample across 2003–2007. Across some years, it is necessary to interpolate missing observations. We use averages from the before and after year values.

30 Although this effect is not strong: the year-on-year correlation of ECERS-R scores for centers that are inspected twice in two years is 0.4 (p-value<0.01).

31 As scores improve, the spread of scores has narrowed: in 2000, the average ECERS-R rating was 3.86 (close to "minimal"); by 2005, the average was 4.75 (close to ëgoodí). Because there is a ceiling of 7 on the ECERS-R, as the average increases the spread tends to narrow. See Frede et al. (2007).

32 The non-Abbott eligible children in private centers are either younger or not residents of an Abbott district. They would not typically be in an Abbott classroom in either case but in separate classrooms and paid for either by parents or through the CDBG or TANF (email communication, Dr. Ellen Frede, NIEER). Given that these children are simply located in the same facility as the Abbott program children, their influence is unlikely to be significant.

Table 4
Cost function: Abbott district private pre-school centers

	Log average cost (per child)	
	Coeff.	(SE)
Program quality: ECERS-R score	0.0196	(0.0090)*
Input prices:		
Lead teacher wage (000s)	0.0215	(0.0074)**
Assistant teacher wage (000s)	0.1367	(0.0159)**
Center-level characteristics:		
Abbott-eligible enrollment	−0.0001	(0.0001)
Any non-Abbott eligible enrollees	−0.0348	(0.0132)**
Multi-site center	0.0304	(0.0227)
For-profit center	0.0384	(0.0144)**
Lease facilities	0.0100	(0.0132)
Demographic controls:		
Percent married	−0.1137	(0.1126)
Percent college educated	−0.1161	(0.2445)
Average income (000s)	0.0303	(0.0390)
Population (00000s)	0.0386	(0.0125)**
R-squared	0.52	
N (classes in centers)	*210*	

Notes: ECERS-R scores taken from inspections in 2005 and 2006. The dependent variable is a pre-school provider's log average per child annual cost for the DOE-funded 6-hour educational component of the school day for 180 days per year. Demographic controls are measured at the district level. Constant term is included. *significant at 5%; **significant at 1%.

An improvement in the quality of the pre-school program (a one unit increase in the ECERS-R score) is associated with a 2% increase in average costs. An increase in the wages of assistant teachers of $1,000 is associated with a 1% increase in costs; but there is no statistically significant effect on costs if lead teachers' wages are increased.[33] The district-level characteristics show again that there is no significant impact on costs of district size; scale effects are not strong. There is no correlation between unit costs and the percentage of three year-olds enrolled or the percentage in private centers. The percent of Head Start enrollees is associated with higher public program costs.

To check for robustness we estimated the public program cost function separately for each year.[34] Table 6 reports key results from separate cost functions for the samples from 2003 to 2007 (the specifications are identical to those in Table 5 except that

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33 This result (higher pay does not cost more) is counter-intuitive, but it may be explained. First, there is a very high correlation between the two wage values across districts (this multicollinearity reduces our ability to identify correlations). Second, it may reflect a very high degree of substitutability across staffing types. Third, centers may use staff whose wages are not included in these equations because of missing data.

34 For private centers we included scores from 2006 to improve the sample size (but only for centers which were not inspected in 2007). A dummy variable to distinguish these scores is not statistically significant. We therefore interpret this to mean that year on year fluctuations in resources do not substantially influence quality.

Table 5
Cost function: Abbott district public pre-school programs

	Log average cost (per child)	
	Coeff.	(SE)
Program quality: ECERS-R score	0.0159	(0.0078)*
Input prices:		
Lead teacher wage (000s)	-0.0021	(0.0012)
Assistant teacher wage (000s)	0.0094	(0.0015)**
District-level characteristics:		
Pre-school enrollment (000s)	0.0001	(0.0000)
Pre-school enrollment sqd (000s)	-0.0000	(0.0000)*
Percent 3-year olds	0.0930	(0.1517)
Percent private center enrollees	0.0477	(0.0325)
Percent Head Start enrollees	0.8900	(0.1486)**
Demographic controls:		
Percent married	0.6926	(0.1491)**
Percent college educated	1.3531	(0.3097)**
Average income (000s)	-0.0124	(0.0046)**
Population (0000s)	-0.0011	(0.0006)
R-squared	0.36	
N (classes in centers)	535	

Notes: ECERS-R scores taken from inspections in 2003–2007. The dependent variable is a pre-school provider's log average per child annual cost for the DOE-funded 6-hour educational component of the school day for 180 days per year. Demographic controls are measured at the district level. Four year dummies (2004–2007) and a constant term are included. *significant at 5%; **significant at 1%.

there are now no year dummies). The effect of program quality is strongest in 2003, with a 1 unit increase in ECERS-R rating associated with costs 4.6% higher. This is plausible: as centers and programs develop over time and the rating standards become known, pre-school provision will more closely track this rating. Table 6 also shows that the relationship between proportion of 3-year olds and costs is typically positive, conforming to extant evidence. The null result in the pooled regression is driven by one year (2006), and this is a year for which our measure of the proportion of 3-year olds is interpolated. Hence, we might anticipate that serving more 3-year olds will entail higher per-child expenditures.

Predicted pre-school costs

Based on the above cost functions, we calculate the costs of well-planned and high-quality pre-school for private centers and public programs. These predicted costs assume that the current expenditures should be increased in several ways.[35]

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35 We cannot use the model to generate predicted values of costs for each district. These cost functions are only a sample of all centers and programs (as well as being spread over multiple years).

Table 6
Cost functions: Abbott district public pre-school programs by year

	Log average cost				
	2003	**2004**	**2005**	**2006**	**2007**
Program quality: ECERS-R score	0.0460 (0.0194)*	-0.0098 (0.0078)	0.0218 (0.0114)	0.0123 (0.0189)	-0.0009 (0.0075)
Percent 3 year olds	0.7123 (0.2734)*	-0.0446 (0.2192)	1.4773 (0.4319)**	-1.8116 (0.7870)*	0.8010 (0.3305)*
N	103	109	114	119	90

Notes: Estimation includes all variables as per Table 5 (except year dummies).
* significant at 5%; ** significant at 1%.

First, program quality must be raised directly. We assume that the average ECERS quality of each center would need to be raised to six; this is the mid-point of the score high-quality programs receive. Raising the average ECERS-R score to six equates to an increase of 1.07 units per private center and 1.3 units per public program. Costs will be higher by 2.10% and 2.07% respectively.

Second, we also assume that salary costs would need to increase to ensure the Abbott pre-schools hire well-qualified, experienced teachers. To estimate the differences in salaries across teachers within New Jersey we use individual-level administrative data from 2006–07 (NJ DOE). We compare Abbott pre-school teachers with kindergarten teachers from across the state. Regressing wages on experience, race, and education, we find that there is no difference between the two types of teacher in how these characteristics influence pay. For each job a year of experience is associated with an increase in pay of 2.4% (see Appendix Table A7, columns 1 and 2). This is reassuring because these teachers operate on the same pay scale.[36] As noted above, these NJ DOE data show one significant difference between the Abbott pre-school teachers and kindergarten teachers: the former have on average 9.5 years of experience compared to 12.1 for the latter group. This in part reflects the newness of the Abbott pre-school program as new hires typically have less experience than the average worker. As the Abbott pre-school teachers' tenure tends toward the mean, their wages will increase accordingly. The most plausible assumption is that their tenure will equal that of pre-school teachers in other districts across the state, which is 11.3 years. Therefore we estimate that the steady state experience levels of Abbott pre-school teachers are 1.8 years below those of other pre-school teachers. This translates into salaries that would be 4.32% higher than currently. Increasing lead teacher pay by 4.32% raises unit costs in private centers by 0.41% but does not increase unit costs in public centers. If assistant teacher pay goes up by 4.32% unit costs will rise by 1.3% in private centers and by 0.72% in public centers.

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36 The raw average wages across the jobs are significantly different: Abbott pre-school teachers earn $55,504, compared to $57,204 for kindergarten teachers. When we estimate a pooled wage equation for both jobs, there is no significant difference in wages for each job (see Appendix Table A7, column 3). However, this equation does not adjust for working conditions properly and it controls for differences in teacher experience.

Third, the pre-school program is intended to be universal. Expanding enrollments to cover a higher proportion of children might be expected to influence costs (as might a policy change to promote larger centers or programs). Two effects need to be accounted for. One is economies of scale (i.e. how average costs change as firms grow larger). However, neither the extant evidence nor our cost function estimates show significant economies of scale. Indeed, almost half of all providers in the Abbott districts offer one or two classrooms; only one-in-seven offers more than six classrooms (Fuller and Wright 2007). Moreover, the Abbott districts may have more capacity: they are budgeted to serve more students than they actually do enroll (Applewhite and Hirsch 2003). But the second effect of expansion is that more enrollments will necessitate more teachers and other personnel and higher wages will be needed to attract these workers. Based on estimates of labor supply elasticity, to expand the program by 4% would require an increase in wages of 5% (Blundell and MacCurdy 1999). This expansion would increase costs by approximately 3%.

Therefore, the unit cost of well-planned, high-quality pre-school in the Abbott districts is anticipated to be above what is currently spent by 6.8% for private centers and 5.8% for public centers. Therefore, using the figures in Table 2, average unit costs across the Abbott districts should have been $13,441 for private centers and $11,529 for public programs in 2006. For future academic years, an inflation factor of 4% must be applied.

For many reasons, we believe this is a conservative figure. The estimation procedure likely understates the coefficients on quality and input price effects. Notably, our data do not yield evidence on other pressures on resources such as: capital costs (but see Blau and Mocan 2002); K–12 alignment; accountability systems; and special education. On the last item, we note that pre-school special education enrollments are very low and that the biggest influence on the costs of special education is placement in inclusive or self-contained settings. Finally, if additional enrollments are younger than average (aged 3 instead of 4), this might raise costs. Our estimations give modest support to this assumption, but the extant evidence gives strong support. To maintain the conservative nature of our estimates, we do not include a cost premium for serving a higher proportion of three year-olds.[37]

To illustrate the size of the understatement, we consider two domains where our results may be conservative. One is the cost of quality, i.e. what it costs to raise the average ECERS-R score. Our estimates are that an additional 2% in funding would be needed. An alternative, plausible estimate is that from the 2003 equation (the first year of available data and so closer to the underlying relationship between costs and quality) or that from Blau and Mocan (2002). These estimates would mean funding should be increased by an additional 3 or 4 percentage points. The second domain where our results are conservative is for facilities. In our calculations we assume no ad-

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37 We do not investigate family commitments. Low-income families are less able to contribute in-kind resources (books, materials, or time) even as these are often an important contribution to making pre-school effective. For example, Muenchow and Scott (2005) estimate in-kind resources at 30% as large as state contributions. In addition, we do not include any transport costs. These are conventionally estimated at over 7% of per pupil expenditures (Verstegen, 2006).

ditional resources are required. Instead, we might assume that expenditures on capital facilities are sub-optimal to the same extent as expenditures on teachers (although in most public education systems capital spending is usually more deficient than spending on teachers). If we assume capital facilities should be upgraded to the same extent as wage payments that would add another 1 or 1.5 percentage points to the required funding.

4.2 Pre-school program model

The second approach to costing out pre-school is the evidence-based school reform design. This model is based on evidence-based school reform costing templates, as applied to K–12 schooling (Odden et al. 2006). The advantage of this approach is that it is transparent: the deployment of inputs and the prices paid for each of them is clearly set out. The main weakness is that it is questionable whether the reforms themselves are successful in improving outcomes. As noted above, because there is much stronger evidence that pre-school programs are effective this weakness is much less of an issue for pre-school (Barnett and Belfield 2007). Hence, if these model programs are faithfully implemented, it is likely that learning outcomes will be improved.

To cross-check the results using the cost function approach, we consider a range of program designs that are set out in the literature. Notably, these reform programs and templates make varying assumptions about the quality and duration of the pre-school provision. Most refer to class sizes and teacher qualifications in determining quality; none impose requirements to the level stipulated for the Abbott districts. As regards duration, most of the studies calculate costs for a regular pre-school program (i.e., 6 hours over 180 days). Clearly, these calculations will significantly understate the resources needed for a yearlong program with wraparound services.

Two small-scale programs which have received considerable academic attention are the High/Scope Perry Pre-school Program (PPP) and the Chicago Child-Parent Centers Program (CCPC). Both were delivered to disadvantaged populations and both have been found to be highly effective for participants (with evaluations based on high quality research designs). Also, the unit costs have been accounted for and can be translated into New Jersey prices using the CWI.

The PPP program resources are reported in Belfield et al. (2006). This program is intensive and many children participated for more than one year. Adjusting for duration, the CWI, and inflation, the unit cost of the regular program is estimated at $11,440. This is probably an understatement because the program was implemented in the 1960s and the cost of educational services has grown faster than inflation over this period. The budgets for the CCPC program show a per-child cost of $10,680 (calculation based on Temple and Reynolds 2007). This, too, is probably an understatement because class sizes averaged 17 and the program was delivered solely through the public schools.

Expenditures in state-level programs may also inform costs for New Jersey. The large-scale state pre-school programs in Oklahoma and Georgia have been evaluated and have been found to be effective (Gormley 2007; Henry et al. 2003). However, the

NIEER Yearbook reports the state expenditures for a regular year of these programs at $4,940–$7,500; these are highly likely to be understatements of the full cost of these programs (excluding local contributions, in-kind resources and government transfers as well as delivery across different populations and states for full and half day provision). Another broadly comparable program is the District of Columbia's Pre-Kindergarten Incentive Program. This program is a new example of a well-planned pre-school program (OECD, 2006) although it has not been evaluated. But the circumstances in the District of Columbia (high proportions of low-income, minority families) may be similar to those in the Abbott districts. The Program includes many provisions associated with high quality and is targeted at low-income children; the program is for 4-year olds for 6.5 hours per day for 180 days per year. Allocated expenditures for this program are $12,500 per child in 2005. Adjusting for regional price differences, duration, and inflation, the equivalent cost for Abbott districts for the regular pre-school program would be $14,710.

Three studies have investigated what it would cost for California to offer universal pre-school. Muenchow et al. (2005) estimate the hourly costs of universal, high-quality preschool for California. Applying their pre-school costs during the regular school year and child-care costs during the summer months, the total annual cost of pre-school would be $19,140. Manship et al. (2007) apply a professional judgment panel approach. Their model is for high-quality pre-school but with fewer services than are currently included in Abbott pre-school. The assumptions are: maximum staff-child ratio of 1:10; class size of 20; a BA degree for the lead teacher; and only 525 hours per year. Manship et al. (2007) estimate this program would cost $5,310–$6,900 per child. Simply adjusting for prices and duration, the equivalent cost for the regular program in the Abbott districts would be $11,040–$14,350. In a third study, Karoly and Bigelow (2005) apply unit costs of $6,100 per child for the regular year. However, if the program includes a child-care component for the regular year, the estimated unit costs are $17,650.

Golin et al. (2003) estimate the costs of universal pre-school for Illinois. Their operating costs per hour equate to $9.70 for child care, $6.90 for Head Start, and $10.84 for pre-school (accounting for inflation and the CWI). In addition to operating costs, there are infrastructure costs of 35%. Therefore, the hourly costs are estimated at $13.05, $9.32, and $14.63 respectively. For the regular program for the Abbott districts, the cost per child would be $15,980. Notably, this model assumes a class size of 20 and does not include resources for health services, accreditation or accountability structures.

Brandon (2004) models national average costs of high quality early childhood education. Defining quality in terms of teacher qualifications and class size, Brandon's estimate is for an hourly rate of $4.77 (2004 dollars) for instructional costs. Adjusting for inflation, the CWI for New Jersey, and administrative costs, the corresponding cost

for the Abbott districts would be $6.92 per hour. For the regular program, the cost would be $7,560. However, this is a national estimate, covering students from many different populations.

US GAO (1999) estimated the costs of military child care. Costs were calculated for the air force centers because these are NAEYC accredited. The cost per hour of pre-school is estimated at $5.64 per hour. For 10 hours per day for 240 days, this would amount to $13,540 per child. However, the family circumstances of military personnel are different from families in urban areas.

Augenblick and Pettersen (2001) estimate the costs of universal pre-school as part of a P–16 education system. For a 206-day year and a student-teacher ratio of 8:1, but without teacher aides or explicit NAEYC or NIEER quality benchmarks, the cost per child is $12,999 (NJ price index, 2007$). For 245 days per year, the cost per child would be $15,460.

We also note that in Appendix II in *Abbott vs. Burke* (153 NJ 480), the cost of pre-school was reported at $8,664 for a regular full day (1998 dollars). In 2007 dollars, this cost is $11,090. This figure is almost certainly an understatement: it does not count any of the recent upgrades in program quality, including higher rates of credentialed teachers; it does not factor in start-up investments for new facilities to meet expansions in enrollments; and it assumes that pre-school is only as expensive as K–12 schooling.

Finally, pre-school costs may be calculated simply as a proportion of spending on K–12 education. (This approach is used as a funding formula in some states.) The proportion is expected to be greater than one. There are many pressures that would mean the costs of pre-school would exceed those of K–12 education: provider and class sizes are smaller; the health and screening services are more intensive; the pool of qualified teachers is smaller; and specialized facilities are needed.[38]

These cost estimates listed above are summarized in Table 7. The average cost is $12,276 per child; applied across provider type it would translate into $11,611 for in-district providers and $13,410 for private providers. This overall estimate is 4.45% above the current expenditure of $11,752 (Table 2) and very close to the cost function estimates (Section 4.1). Importantly, the cost estimates in Table 7 are best thought of as calculations of operating costs (with one exception). Few of them include funding either for planning, start-up investments, or a comprehensive accountability system (see Stebbins 2006). Also, they mostly focus on four-year old children, provision for whom is slightly less expensive than three-year olds. Hence, we interpret these estimates as lower bounds on the baseline costs for pre-school in the Abbott districts. As such, they suggest that the cost function estimates are not too high.

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38   The US GAO (1999) estimates the costs of pre-school are 10% higher than K–12 schooling.

Table 7
Template predicted cost estimates for high quality pre-school (New Jersey prices)

Source	Regular program costs (6 hours 180 days)	Regular program plus extended day and summer wraparound
Illinois (Golin et al. 2003)	$15,980	
District of Columbia Pre-K Program	$14,710	
GAO (1999)	$13,540	
California (Manship et al. 2007)	$11,040–$14,350	
Perry High/Scope	$11,440	
Abbott v. Burke (153 NJ 480)	$11,090	
Chicago Child-Parent Centers	$10,680	
Brandon (2004)	$7,560	
California (Muenchow et al. 2005)	–	$19,140
California (Karoly and Bigelow 2005)	–	$17,650
Augenblick and Pettersen (2001)	–	$15,460
Predicted costs:		
Average	$12,276	
Average for public providers	$11,611	
Average for private providers	$13,410	

Notes: Regular program costs do not include wraparound hours. These cost templates do not fully correspond to the Abbott program requirements; the latter are higher quality. Average estimate includes the estimates in columns 1 and column 2 (minus the cost of wraparound services).

5.   TOTAL COST REQUIREMENTS IN NEW JERSEY

5.1 Pre-school costs for Abbott districts

In Table 8 the predicted average unit costs for well-planned, high quality pre-school are given for each Abbott district for the school year 2007–08. These predictions are based on the cost function estimates derived above. We assume that the proportion of children in each setting will be maintained at current rates in each district. We add in an inflation factor of 4% such that these figures would apply to the 2007–08 academic year. For public programs the unit cost is $11,993 and for private centers the unit cost is $13,978.

This increase in costs should also be reflected in budgets for Enhanced Head Start provision. These budgets vary from agency to agency and are based on additional funding required net of federal transfers.[39] Our approach is to assume that the Enhanced Head Start providers need the same amount of extra funding as the public programs. This is the logical approach based on how these centers have historically been funded (and it

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39 We did not estimate a cost function for the Head Start centers. Although the data are available, the sample is small. Also, these providers receive the majority of their funding from federal agencies and so may cross-subsidize pre-school in Enhanced Head Start.

Table 8
Total state costs

	In-district	Private provider	Head Start
Asbury Park	$8,927	$17,040	$8,335
Bridgeton	$11,584	$11,974	$4,824
Burlington City	$10,199	$11,683	–
Camden	$9,570	$12,397	$4,230
East Orange	$10,895	$12,436	$8,449
Elizabeth	$14,705	$17,000	–
Garfield	$11,976	$11,911	–
Gloucester	$12,211	–	–
Harrison	$12,887	$14,891	–
Hoboken	–	$13,224	$10,657
Irvington	$13,106	$14,487	$7,941
Jersey City	$12,392	$14,258	$6,309
Keansburg	$11,350	–	–
Long Branch	$9,918	–	–
Millville	$10,802	$12,111	$5,432
Neptune	$11,135	$14,743	–
New Brunswick	$11,136	$14,127	$3,829
Newark	$10,116	$15,311	$8,902
Orange	$9,827	$13,682	$7,594
Passaic	$13,527	$15,220	$7,145
Paterson	$8,575	$13,316	$7,786
Pemberton	$10,023	$13,069	–
Perth Amboy	$14,192	$13,661	–
Phillipsburg	$11,571	$13,980	$9,430
Plainfield	$8,287	$13,442	$6,886
Pleasantville	$11,605	$13,647	$6,158
Salem	$11,580	–	$8,338
Trenton	$11,736	$14,499	–
Union City	$10,994	$11,273	$8,402
Vineland	$11,787	$14,182	$7,305
West New York	$11,756	$14,307	$8,060
Predicted costs:			
Weighted average 2007–08	$11,993	$13,978	$8,189
Weighted average 2006–07	$11,532	$13,441	$8,517

Notes: Missing cells denote no provision or information not available. Spending does not include DHS funding for wraparound services. Weighted average accounts for district enrollment patterns.

assumes that federal Head Start subsidies are unchanged). So, if $660 of extra funding is in fact required for public programs to attain the district standards, then the same absolute amount should be made available for the Enhanced Head Start providers. Therefore, funding for Enhanced Head Start should rise to $8,189 for the 2007 academic year. (An alternative approach is to apply the current implicit funding weight for Enhanced Head Start, implicitly assuming no efficiency differences with respect to total spending. In 2006, Enhanced Head Start funds were 58% of funds for private centers and 66% of funds for in-district providers. Applying these percentages yields a cost estimate average of $8,011.)[40]

Finally, we consider the implications for the costs of wraparound services. Presently, these are funded at $5,110 for accredited pre-schools. Unlike the 6-hour educational component of the preschool day, activities, class sizes, or staffing levels for the wraparound services are not prescribed. Nevertheless, the facilities are the same and managerial time spent on these services is likely to cost the same. Yet, the disparity in hourly funding is significant: on existing budgets, the hourly reimbursement rate for public pre-school programs is almost $10; for the child care component it is under $4 (assuming child stay for the entire wraparound service duration). Golin et al. (2003) calculate that pre-school is only 1.5 times more expensive than child care, with most of the extra funding spent on professional staff. If this ratio is applicable, it implies that the reimbursement rate for child care should be closer to $6.50 not $4 per hour. We do not propose this reimbursement rate here, but recognize that the disparity in funding between pre-school and child care is sufficiently large as to merit further research.

A final caution is regarding the costs for special education. We have not explicitly calculated the additional costs for children requiring these services. One approach is to apply the consensus weighting of 1.9 times regular program aid (Chambers et al., 2003). As shown in Appendix Table A3, the proportion of children in self-contained special education pre-school is low. The impact on costs of a choice of weight is unlikely to influence total costs substantially. However, it is likely that these children require additional services which cannot be estimated using a simple weighting based on per-child amounts in mainstream settings. Assuming all special education provision is run through the public programs, the unit cost is therefore $22,788.

5.2 Pre-school costs across New Jersey

The above unit cost estimates from the cost functions are used to calculate funding requirements across the rest of New Jersey. We extrapolate to provision in ECPA-funded districts and state-wide. The formula for adjustment is the cost index created by Taylor and Fowler (2006).[41]

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40 As a validity check we considered a third approach: to use the research literature to cost out high-quality Head Start provision. Two separate research studies report that the cost of high quality Head Start is 22% or 40% more than is currently being spent. Currie and Neidell (2007) use administrative PCCOST data to calculate the cost of ensuring high quality outcomes from Head Start; they estimate funding would need to rise by 40%. NIEER (2006) use salary data to calculate the cost of ensuring that all Head Start teachers are paid equivalent to K–12 teachers; their estimate is that funding would need to go up by 22%.

41 We assume that the distribution of enrollments across provider types is the same across all districts in New Jersey.

This educational cost index has very similar values across all districts in New Jersey. The index value for the non-Abbott ECPA-funded districts is 95.6% of the value for the Abbott districts. The index value for the rest of New Jersey (neither Abbott nor ECPA-funded districts) is 99.2% of the value for the Abbott districts. Therefore we do not anticipate that the unit costs of pre-school across the state will vary significantly from the cost in the Abbott districts. For ECPA-funded districts, the predicted cost for 2007–08 is $11,476 for public programs and $13,375 for private centers. For other districts in New Jersey the respective costs are $11,907 and $13,878.[42]

5.3 Total programs costs

The total program costs for pre-school are the unit costs times the number of partici-pants. Clearly, these total costs will depend on how many children enroll. For the Abbott districts, an increase in enrollment of 4% is predicted: this would mean 40,456 children participating. As shown in Table 9, the total amount of funding would be $528 million for 2007-08. Almost $310 million would be allocated to private centers, with $167 million for public programs, $27 million for Enhanced Head Start and $24 million for special education.

Future enrollment rates are not known with confidence for non-Abbott ECPA-funded districts and other districts across the state. Again, the total costs are simply unit costs times total enrollment. Two simple calculations are shown in the lower panels of Ta-ble 9. For the ECPA-funded districts, enrollment is currently 7,270 so the total fund-

Table 9
Total costs of high-quality pre-school for New Jersey: Predicted enrollment in 2007-08

	Predicted enrollment	Amount of annual funding required (millions)
Abbott districts:	40,456	$528.00
Public programs	13,962	$167.46
Private centers	22,124	$309.26
Enhanced Head Start	3,307	$27.09
Special education	1,062	$24.20
ECPA-funded districts:	7,270 (current enrollment)	$90.79
Expansion to rest of NJ districts:	50,000 (by assumption)	$652.34

Source: NJ DOE for Abbott enrollment. NIEER 2006 Yearbook for ECPA-district data.
Notes: Funding for regular program of 6 hours per day, 180 days per year. Costs estimated for the 2006-07 year. Special education in self-contained programs. ECPA-funded districts are assumed to have provision equal in standards to the Abbott districts. The distribution of places across settings is assumed to be the same as the current distribution in the Abbott districts.

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42 Similarly, these are conservative numbers. A large scale expansion of the program would necessitate hiring more staff and to attract more workers districts would have to offer higher salaries.

ing requirement would be $91 million annually to provide pre-school of equal quality to that in the Abbott districts. Across the rest of New Jersey, there is much greater potential for increasing the participation rate but this will depend on many factors outside the scope of this analysis. As a simple scenario, if 50,000 places were created to meet the Abbott district standards, the total funding required would be $652 million annually. These cost figures are illustrative estimates and would be affected by a number of factors, including: the proportion of children served in private programs; the capacity of Head Start providers to offer Enhanced Head Start; and the opportunities for teachers to acquire pre-school credentials.

6. CONCLUSION

The evidence on how high-quality pre-school improves the academic performance of children is compelling. After a rapid expansion over the last decade, many children in the Abbott school districts in New Jersey now have an opportunity to enroll in high-quality programs. However, the Abbott pre-schools face a number of challenges to ensure that the program remains high quality. The most important challenge is to ensure that the teaching force consists of highly qualified teachers who are paid adequate market wages.

Fundamentally, high quality programs need to be fully funded. Based on a full analysis of the resources required for pre-school our analysis suggests that it would cost $12,736 to ensure high quality pre-school in the Abbott districts. This cost is approximately 6% above the amount currently spent. The additional funding is necessary to ensure that new teachers can be hired and that existing teachers are retained.

In estimating this figure, we identify two key issues regarding the optimal investment in pre-school across New Jersey. First, the additional increment in investment is not significantly above the rate of inflation. Therefore, making sure that the rate of change of prices is calculated accurately is important to ensure that the program is adequately funded. Second, it is important to ensure that the workforce is efficiently structured and that future wage increases are anticipated. The Abbott pre-school program has grown rapidly over a short time period such that many of the pre-school staff are new to their positions. Retaining these staff will be important to ensure program quality. But retaining these staff will also put pressure on costs: many of these teachers may have offers from other schools and districts as the labor market changes; and as these teachers gain more experience their salaries will rise correspondingly. It is likely that upward pressure on wages will necessitate additional funding.

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Table A1
Inputs for pre-school regular program requirements: Abbott districts

Inputs	Requirements
Center-level:	
A. Program-driven:	
Certified teacher	1+ per class
Assistant teacher	1+ per class
Assistant teacher–floating	1 per 6 classes
Substitute teacher	0.07 per class
Materials/supplies	$2,000 per class
Technology	$800 per class
Field trips	$75 per child
Family worker	1 per 45 children
Cook	1 per 90 children
Assistant cook	1 per 180 children
Food	Per child
B. Administration	
Pre-school director	1 per center
Rent, mortgage, space	Per center
Start-up expenses	$14,450 per new classroom
Other indirect expenses	
District-level:	
A. Program-driven	
Community/parent involvement specialist	1 per district
Early Childhood Advisory Council	1 per district
Master teacher	1 per 300 children
Social worker	1 per 300 children
Pre-school intervention/referral team	1 per 750 children
Nurse	1 per 300 children
Recruitment & outreach	$10 per enrolled child; $20 per new enrollee
Medical supplies/equipment	$32 per child
In-district staff development	Per child
Out-of-district staff development	Per staff
Parent workshops	
B. Administration	
Supplies/equipment	Fixed per center
Computing	Fixed per staff
Management/supervision:	
Assistant superintendent *or*	1 per 4000 children
ECE director *or*	1 per 3000 children
Supervisor	1 per 750 private preschoolers
Clerks	2–4 per district
Fiscal specialist	1 per 8 providers

Note: All staffing positions include payments for benefits. These are inputs for the regular day program, not the extended-day or summer wraparound programs.

Table A2
Pre-school enrollments in Abbott districts (2006-07)

District	Age		Total enrollment	Percent of eligible children
	3	**4**		
Asbury Park	253	239	492	93%
Bridgeton	378	389	767	104%
Burlington City	88	114	202	80%
Camden	717	998	1,715	63%
East Orange	642	843	1,485	71%
Elizabeth	1,171	1,505	2,676	73%
Garfield	278	320	598	86%
Gloucester	103	155	258	84%
Harrison	151	201	352	100%
Hoboken	162	188	350	67%
Irvington	581	665	1,246	85%
Jersey City	2,124	1,788	3,912	65%
Keansburg	137	119	256	86%
Long Branch	375	395	770	90%
Millville	361	412	773	93%
Neptune	217	337	554	82
New Brunswick	494	706	1,200	85
Newark	2,389	3,346	5,735	67%
Orange	315	450	765	89%
Passaic	822	987	1,809	75%
Paterson	1,613	1,768	3,381	71%
Pemberton	239	340	579	78%
Perth Amboy	548	651	1,199	72%
Phillipsburg	154	214	368	80%
Plainfield	570	636	1,206	78%
Pleasantville	180	302	482	74%
Salem	79	65	144	90%
Trenton	731	1,079	1,810	77%
Union City	783	871	1,654	86%
Vineland	516	611	1,127	77%
West New York	483	552	1,035	96%
TOTAL	**17,654**	**21,246**	**38,900**	**75%**

Note: Districts tabulate the total number of eligible children by applying a ratio to the number of children enrolled in specific elementary grades in the district.

Table A3
Pre-school enrollments in Abbott districts (2006–07)

	In-district public	Private	Head Start	Special education
Asbury Park	4%	77%	19%	2%
Bridgeton	52%	37%	12%	1%
Burlington City	87%	13%	0%	4%
Camden	25%	74%	1%	3%
East Orange	33%	52%	15%	1%
Elizabeth	81%	19%	0%	2%
Garfield	84%	16%	0%	2%
Gloucester	100%	0%	0%	4%
Harrison	4%	96%	0%	3%
Hoboken	2%	65%	33%	6%
Irvington	14%	79%	7%	2%
Jersey City	48%	45%	7%	1%
Keansburg	100%	0%	0%	6%
Long Branch	100%	0%	0%	2%
Millville	71%	25%	4%	3%
Neptune	95%	5%	0%	2%
New Brunswick	11%	86%	3%	2%
Newark	16%	62%	22%	3%
Orange	14%	56%	30%	4%
Passaic	74%	20%	6%	2%
Paterson	4%	95%	1%	2%
Pemberton	71%	29%	0%	6%
Perth Amboy	83%	17%	0%	2%
Phillipsburg	58%	27%	15%	5%
Plainfield	4%	84%	12%	2%
Pleasantville	55%	40%	5%	2%
Salem	83%	0%	17%	2%
Trenton	24%	76%	0%	3%
Union City	20%	75%	6%	1%
Vineland	19%	72%	8%	4%
West New York	30%	64%	6%	1%
TOTAL	**16,155**	**23,790**	**3,555**	**994**

Notes: Special education enrollments are those in non-inclusive settings. (Based on 2006–07 Approved Enrollment Numbers (NJ DOE; Office of Early Childhood Education).

Table A4
Compensation for pre-school teachers

	Hourly wages (SD)	Annual compensation (SD)	Health benefits	Retirement benefits
NJ Abbott districts	$24.36 ($8.04)	$39,600 (9,010)	94%	65%
NJ ECPA-funded districts	$28.04 ($10.36)	$41,370 (14,150)	96%	87%
National average	$25.70 ($12.04)	$39,750 (16,280)	89%	80%

Source: Gilliam and Marchessault (2005), Tables 6–9. Wages adjusted using weights from Fowler and Taylor (2006).
Notes: These salary figures do not account for differences in working conditions.

Table A5
Descriptive frequencies for sampled private pre-school centers

	Mean	SD
Average cost per center	$10,721	$2,231
Log average costs	9.28	0.12
ECERS-R score	4.93	0.72
Abbott-eligible enrollment	82.3	60.8
Any non-Abbott eligible enrollees	0.35	
Lead teacher wage (0000s)	4.46	0.85
Assistant teacher wage (0000s)	2.20	0.47
For-profit center	0.33	
Lease facilities	0.52	
Multi-site center	0.12	
Percent married	0.47	0.06
Percent college educated	0.11	0.06
Average income (0000s)	1.54	0.39
Population (00000s)	0.88	0.64
Observations	**210**	

Notes: Frequencies for sample estimation in Table 4.

Table A6
Descriptive frequencies for sampled public pre-school programs and districts

	Mean	SD
Average cost per program	$9,130	$1,428
Log average cost per program	9.11	0.15
ECERS-R score	4.70	0.85
Lead teacher wage (000s)	54.39	7.72
Asst. teacher wage (000s)	26.11	6.35
District pre-school enrollment	2436	1956
Percent 3-year olds	0.45	0.06
Percent private center enrollees	0.47	0.27
Percent Head Start enrollees	0.05	0.07
Percent married	0.49	0.06
Percent college educated	0.12	0.06
Average income (000s)	16.14	3.12
Population (0000s)	79.33	67.28
Year 2003	20%	
Year 2004	20%	
Year 2005	21%	
Year 2006	22%	
Year 2007	17%	
Observations	**535**	

Notes: Frequencies for sample estimation in Table 5.

Table A7
Determinants of salaries in New Jersey public school districts

	LN (Salary)		
	Kindergarten teachers	**Abbott pre-schoolteachers**	**Pooled sample**
Years of experience	0.0227 (0.0004)*	0.0227 (0.0006)*	0.0227 (0.0004)*
Sex	−0.0204 (0.0262)	0.0044 (0.0280)	−0.0129 (0.0206)
Advanced degrees	0.1009 (0.0100)*	0.1070 (0.0124)*	0.1032 (0.0081)*
White	−0.0025 (0.0198)	0.0083 (0.0165)	0.0010 (0.0142)
Black	−0.0095 (0.0233)	0.0063 (0.0200)	−0.0048 (0.0170)
Abbott pre-school teachers			0.0026 (0.0106)
R-squared	0.69	0.81	0.71
Districts	226	21	227
Observations	1637	453	2090

Source: NJ DOE administrative data, 2006–07.
Notes: District-specific fixed effects OLS estimation. Constant term included. Standard errors in parentheses. * significant at 5%; ** significant at 1%.

Table A8
National differences in spending on state pre-school programs across quality benchmarks

Benchmark	Spending		
	Programs meet quality benchmark	Programs do not meet quality benchmark	Extra spending per benchmark
Standards	$4,200	$3,090	$1,110
Teacher has BA	$3,700	$4,250	($550)
Teacher has credential	$4,280	$2,950	$1,330
Aide training	$4,400	$3,810	$590
In-service training	$3,710	$4,430	($720)
Class-size (<20)	$4,170	$3,100	$1,070
Staff-child ratio (<10)	$4,200	$2,720	$1,480
Health services	$4,240	$3,240	$1,000
Meals	$4,810	$3,090	$1,720
Inspection	$4,250	$3,040	$1,210
Average extra spending per benchmark			$824

Source: NIEER Yearbook (2006); *N*=48.