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23 Years of State Pre-K Expansion: How States Balance Investment, Access, and Quality in the Modern Era

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We describe state-funded pre-kindergarten (pre-K) expansion in the modern era from 2002 to 2024, documenting patterns of investment and reach. Although spending and enrollment increased substantially, states pursued widely varying expansion strategies. A 200% increase in pre-K enrollment did not reduce spending on enrolled children. Instead, we observed an average increase of 21% in per-pupil spending. Overall enrollment rates in any form of preschool (including the private market) did not differ between states offering universal and means-tested (targeted) programs, though states with universal eligibility saw more children enroll in the state-supported programs. Preschool enrollment of children from low-income families did not differ across universal and means-tested programs. Observable state characteristics did not predict pre-K investment. Implications for policy are discussed.

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23 Years of State Pre-K Expansion: How States Balance Investment, Access, and Quality in the Modern Era

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Author Note

Prior to the time of publishing, we will publicly post the dataset, codebook and syntax to replicate these analyses.

Abstract

We describe state-funded pre-kindergarten (pre-K) expansion in the modern era from 2002 to 2024, documenting patterns of investment and reach. Although spending and enrollment increased substantially, states pursued widely varying expansion strategies. A 200% increase in pre-K enrollment did not reduce spending on enrolled children. Instead, we observed an average increase of 21% in per-pupil spending. Overall enrollment rates in any form of preschool (including the private market) did not differ between states offering universal and means-tested (targeted) programs, though states with universal eligibility saw more children enroll in the state-supported programs. Preschool enrollment of children from low-income families did not differ across universal and means-tested programs. Observable state characteristics did not predict pre-K investment. Implications for policy are discussed.

Keywords: Prekindergarten, early childhood education, preschool, per-pupil expenditure, funding, state policy

Since the turn of the 21st century, the advent of public pre-kindergarten (pre-K) has attracted broad interest and investment. Widely considered one of the most significant expansions in U.S. educational policy, inflation-adjusted investment in pre-K grew from $4.8 billion in 2002 to $13.6 billion in 2024 (Friedman-Krauss et al., 2025). In 2024 alone, 39 states increased spending on pre-K by nearly $2 billion compared with the previous school year (Friedman-Krauss et al., 2025). This growth in investment has been accompanied by an increase in enrollment in broadly defined early childhood education (ECE) since 1965, owing increasingly to publicly funded programs (Chaudry et al., 2021).

Yet, like most other child and educational policies, public pre-K policy is developed by states, resulting in significant variation in approaches to expansion (Jenkins, 2014). This reliance on state-level leadership reflects differences in the social, political, and economic conditions of states and their policymaking (Berry & Berry, 2018). In turn, state leaders have taken different approaches to several major policy dimensions.

First, states vary in how they balance the tradeoff between access (i.e., expanding supply and enrollment to serve more children) and quality (i.e., expenditures per enrolled child). Expanding supply without reducing quality has been a significant challenge in childcare markets (Hotz & Xiao, 2011). States also have varied eligibility criteria. Some states have expanded scaled-up means-tested programs, while others have pushed for universal reach.

Historically, preschool expansion has been motivated by efforts to improve children's skills at school entry. Pervasive achievement gaps by socioeconomic status (Reardon, 2018) have prompted calls to channel ECE resources to children growing up in economically disadvantaged communities. Two famous randomized evaluations of highly intensive programs targeted toward severely disadvantaged children served as "demonstration" models for targeted preschool (see Elango et al., 2016). However, others have argued that pre-K should be an entitlement that expands the sphere of education as a public good, given that high-quality programs offer meaningful benefits for all children (Barnett, 2011). Some scholars also contend that means-testing for preschool can inadvertently restrict access and quality (Zigler et al., 2011).

Today, there exist open questions about quality-quantity tradeoffs in pre-K. As some states expand eligibility requirements and the reach of their programs, budget constraints may limit the quality of services for enrolled children. Indeed, long-standing calls from pre-K advocates have encouraged the field to shift focus from expanding reach to ensuring quality (Chaudry et al., 2021; Kirp, 2007; Rose, 2010). Yet it is also possible that as states expand the number of children they serve, they can maintain quality, broadly defined. These tensions are not unique to pre-K. Safety net programs like Medicaid, WIC, and SNAP have a history of balancing questions of access, cost, and program quality, with different programs

often oscillating between expansions of eligibility and efforts to contain expenditures (Moffitt, 2007).

These debates are reflected in both the implementation of and scholarship on publicly funded pre-K. Large-scale, rigorous, long-term evaluations of different modern-day state-funded pre-K programs have produced mixed findings—positive, negative, and null impacts—causing controversy over the generalizability of reported impacts for any single program (Burchinal et al., 2024; Watts et al., 2023). Researchers are examining why such disparate results exist (Whitaker et al., 2025), including the possibility that differences in program quality (McCormick, 2024), implementation, the population served, or the state policy context shape program effectiveness. The variation in pre-K programs across the country presents challenges not only for researchers but also for policymakers deciding how best to spend limited resources.

To put evaluative findings into context and assess the extent to which they generalize, we present a descriptive analysis of state pre-K investment over the past two decades. We leverage the data collection efforts of the National Institute of Early Education Research (NIEER) to describe U.S. states' scale-up of public pre-K from 2002 to 2024. ECE researchers and practitioners know the work of NIEER for their publication of the annual pre-K "yearbook," which documents the status of public pre-K in each state (Friedman-Krauss et al., 2025). We draw on multiple sources of NIEER archival data to generate a new, state-by-year dataset on 21st-century pre-K scale-up. This new study, called State Pre-K Expenditures: A National Dataset (SPEND), combines detailed pre-K investment and program data with other publicly sourced state and policy characteristics. Here, we provide a comprehensive view of pre-K expansion over this period, mapping states' scale-up in investment and enrollment and characterizing the distinct pathways taken. We then investigate the extent to which contemporary state-funded programs balance access, quality, and eligibility, presenting analyses and figures that quantify these potential tradeoffs. In so doing, we expand the field's understanding of the broader scale-up efforts underway nationwide.

The Current Study

We first examine trends in state spending on and enrollment in state-funded pre-K over two decades and test whether state characteristics—including political party leadership, economic strength, and demographic makeup—explain differences in spending trajectories across states.

Next, we investigate potential quantity-quality tradeoffs in states' programs over time, examining the interplay between access for more children and per-pupil expenditure for enrolled children. We incorporate state eligibility requirements to contrast enrollment trends of states with and without means-tested approaches. We further examine whether means-tested programs are more

successful at reaching higher shares of economically disadvantaged students in their state.

Research Questions

1) How has investment in state pre-K changed over the last 23 years?
2) Do state characteristics predict patterns of state pre-K spending?
3) Do states trade off between expanding access to more children and per-child expenditures?
4) How does reach vary across states with universal income eligibility versus those with means-tested programs?

Method

Our analyses primarily draw from archival records collected by NIEER, which gathered annual data on each state's pre-K program(s) beginning in 2002 via surveys of state-level administrators. To be included in the NIEER report, a given program must be funded and managed by the state (excluding city- or locally-funded programs, unless those programs operate as part of the state-funded system), serve children at ages 3 or 4, and have a primary focus on providing ECE.

The NIEER dataset includes annual spending by funding source (state, local, federal), as well as program enrollment and state population by age (3- and 4-year-olds). From these data, we generated several measures of state pre-K spending and enrollment. Here, we provide a brief overview of key methodological processes. Further details are provided in the online supplement.

State Pre-K Spending

We used two measures to depict patterns of state investment in pre-K: (1) state spending per 4-year-old in the state's population, and (2) state spending per *enrolled* 4-year-old (i.e., per-pupil spending). Each measure includes state funding sources only, a distinction made by NIEER that isolates state-generated funding from local or federal sources (see additional information in the Supplement).

We scaled the total dollars spent toward state pre-K to 2024 USD using the Consumer Price Index (CPI). To account for possible funding allocations to 3-year-old children (13-18% of state pre-K enrollment nationwide across the panel was 3-year-olds), we multiplied each state's funding total by the proportion of its enrolled population who were 4 years old in a given year. We then divided this 4-year-old-adjusted spending by the state's total population of 4-year-olds to arrive at our key measure: single-year pre-K spending per 4-year-old child.

To calculate the funding level for each enrolled child, we divided our CPI- and 4-year-old-adjusted total spending by the number of enrolled 4-year-olds.

Pre-K and ECE Enrollment and Access

State pre-K enrollment rates were calculated by dividing the number of 4-year-olds enrolled in state-funded pre-K (as reported by the state agency in

NIEER's annual survey) by the total 4-year-old population in that state and year, obtained from the U.S. Census. The 4-year-old enrollment rate thus represented NIEER's tracking of the reach of a state's pre-K program(s) relative to the entire preschool-age population (i.e., 4-year-olds).

We also constructed alternative measures of ECE access using the American Community Survey (ACS) and Common Core of Data (CCD). A representative sample of parents self-reported for the ACS survey, and we generated state-year estimates of preschool enrollment among all and low-income 4-year-olds (≤185% of the Federal Poverty Level). We included enrollment in both public and private programs to capture broader access. From the CCD, we estimated the availability of pre-K in high-poverty neighborhoods, calculating the percentage of Title I elementary schools in the state that offered a pre-K program. For additional details regarding the rationale behind these variables, see the online supplement.

State Policy for Means-Tested Versus Universal Pre-K Eligibility

We generated a binary indicator of the eligibility standard for 4-year-olds among states with a pre-K program: those that had (1) no income requirements (i.e., programs with the potential for "Universal" reach); or (2) some family income-eligibility criteria (i.e., "means-tested" or "Targeted" programs). Figure S1 shows the portion of states in each category. We note that although many states had a Universal policy, this does not imply universal *enrollment*, an empirical gap we aim to address. Note also that although states categorized as Universal included no income eligibility criteria, some did prioritize enrollment based on other risk factors (e.g., child disability). We focused on income-based requirements as these were the most consistently documented. In the online supplement, we conducted these analyses using a more stringent definition of Universal (i.e., accessible to all age-eligible children) to test the sensitivity of our main results.

Eligibility criteria were reported at the program level, which we aggregated to the state level. See the supplemental file for more details.

State Characteristics

To understand how state features may have influenced their scale-up trajectories, we integrated a wide set of state characteristics (e.g., economic, demographic, political) from public sources. The online supplement provides the full list of these measures and accompanying information (Tables S1 through S3).

Analysis

We paired descriptive time-series figures with simple regression analyses and statistical comparisons to examine patterns of state-specific pre-K spending and enrollment. Below, we summarize the analytic steps used to construct and examine these spending and enrollment measures, before presenting findings (see more details in the Supplement).

Results

RQ1: How has investment in state pre-K changed over the last 23 years?

Figure 1, Panel A plots each state's pre-K spending per 4-year-old in the state from 2002 to 2024, with each gray line representing a different state. On average, annual state pre-K spending per 4-year-old in the population gradually rose from $667 in 2002 to $2,054 in 2024 (a 208% increase, accounting for inflation). States varied greatly, however, in the slope and level of spending.

Next, we compared states to identify common patterns of pre-K expansion. Two coders independently categorized each state into "spending trajectories". Discrepancies (five total across the 50 states) were resolved through discussion among the author team. Additional coding information is provided in the online supplement, with individual growth figures for each state (Figure S2).

This process led to four categories of pre-K spending. A large group showed upward trajectories in spending over the 23-year panel, which we named "High Growth" (Panel B). Eighteen states met this definition. By 2024, on average, states in this category had grown their initial 2002 investments by 22 times (inflation adjusted). Even within this group, individual trajectories varied. For example, New Mexico, among the top spenders in 2024 ($6,728 per 4-year-old in the state), spent under $100 per 4-year-old during the panel's early years, then rapidly increased spending over the past decade. West Virginia, in contrast, consistently spent at least $1,500 per 4-year-old over the past two decades, and steadily increased spending before leveling off at approximately $5,000 per 4-year-old since 2011.

The remaining states displayed one of three patterns of relatively stable pre-K spending. "Low Growth/ Higher Spending" states (n = 11; Panel C) started the 21st century with relatively high spending levels that were maintained over the panel (each averaged over $1,000 per 4-year-old across all years). This group includes some states with well-known evaluations, such as Oklahoma, North Carolina, and Tennessee.

"Low Growth/ Lower Spending" (n = 13; Panel D) included states that averaged less than $1,000 in spending per 4-year-old from 2002 to 2024. Notably, we included several states in this panel that began without a program (e.g., Mississippi) and have since adopted one with limited funding. Interestingly, while no states showed a steady decline over the course of the panel, a few had higher spending in 2002 than they did in 2024. Hawaii, Massachusetts, and Ohio reduced spending by 16%, 22%, and 30%, respectively.

Finally, "No Program" states (n = 8) never had state-funded pre-K or only briefly implemented programs.

As a check, we also examined states' spending trajectories after adjusting for the cost of living (see more details in the Supplement) and found that they did not differ meaningfully (Figures S3 and S4).

RQ2: Do state characteristics predict patterns of state pre-K spending?

We next explored whether state-level characteristics were associated with membership in the four categories of state pre-K spending. We began by averaging each state covariate over the 23-year panel (see Table S4 for descriptives) before predicting group membership in a series of linear probability models. As the results in Table 1 reflect, we did not observe a clear pattern of selection based on observable state characteristics into spending trajectories. States with a democratic governor, lower Gross State Product (GSP) per capita, and higher rates of youth in juvenile detention positively predicted membership in the "High Growth" group (compared with the other three). States with "Low Growth/ Higher Spending" had higher GSP per capita and higher child poverty rates, but lower percentages of women in public office, Medicaid spending per person, and youth juvenile detention rates. To contextualize these results, we also included, in the last column, results from a regression model in which we regressed average state spending (a continuous variable) on each state characteristic.

To examine whether initial state features predicted future pre-K investment, we replicated the above analyses using baseline (2002) state characteristics to predict membership in each spending trajectory group (Table S5). Finally, we conducted a time-varying analysis in which each state characteristic predicted the following academic year's pre-K spending (Table S6). Across these analyses, we did not observe clear patterns of prediction.

RQ3: Do states trade off between expanding access to more children and per-child expenditures?

To examine the potential tradeoff between investment per child enrolled in pre-K and program access or reach, we first plotted "per-pupil expenditure" across states over time (Figure 2). Changes in this variable could be reflective of any number of programmatic features that define children's experiences (e.g., length of day, teacher: child ratio, teacher salary). We then compared it to the enrollment rate among all age-eligible children. By contrasting these two metrics—one reflecting the *number* of children served and the other representing the level of investment those children received (i.e., one indicator of *quality*)—we can observe, broadly, where states directed their growing pre-K investments.

As shown in Panel A of Figure 2, we found that state spending per pupil (i.e., enrolled 4-year-olds) increased by 21% since 2002, reaching $6,325 in 2024. We then used our spending categories to examine differences in per-pupil spending in the remaining panels of Figure 2. Here, we found no evidence of a tradeoff between expansion and spending for enrolled students. Instead, some high-growth states showed marked increases in their per-slot funding, even as they expanded access (e.g., California).

Figure 3 depicts changes in enrollment rates over time. As Panel A shows, the average percentage of 4-year-olds enrolled in each state's pre-K programs consistently rose from 10% in 2002 to 30% by 2024. Again, individual states varied substantially. Those with "High Growth" in spending (Panel B) showed marked increases in the number of slots their programs supported. States in the "Low Growth" pre-K investment groups (Panels C and D) exhibited more stable enrollment rates, though some increased enrollment (e.g., Wisconsin, Kansas, Nebraska). Notably, these trends were interrupted in 2021 following the COVID-19 pandemic but largely returned to pre-pandemic levels in 2022.

Summarizing our calculations, the 208% increase in states' pre-K investments from 2002 to 2024 funded a 200% increase in the proportion of children enrolled and a 21% increase in the average spending for each enrolled child. To further quantify the relation between expansion into the 4-year-old population and spending on child slots, we regressed per-pupil spending on the 4-year-old enrollment rate, with state and year fixed effects included (Table S7). We found that a one-percentage-point increase in the enrollment rate predicted a nonsignificant $19 increase in spending per slot (p = .28), indicating no trade-off between access and quality investment (see Table S7). (This was also robust to the exclusion of the 2020-2021 academic year, heavily affected by COVID-19; Table S8).

RQ4: How does reach vary across states with universal income eligibility versus those with means-tested programs?

To examine how enrollment patterns differed across states with varying eligibility requirements, we relied on several enrollment measures, each capturing distinct constructs and reflecting distinct dimensions of access. We review the implications of these distinctions below.

In many states, eligibility criteria have shifted over time, and these shifts may affect enrollment in hard-to-determine ways (e.g., a shift from Targeted to Universal could take several years to affect enrollment). Thus, we first focused on a subset of states with consistent eligibility requirements over a common period of our panel. We identified 23 such states spanning 2005 through 2019 (see the online Supplement for details). We also examined the most recent year of data (2024) in isolation, and relaxed our inclusion criteria to include all states, regardless of whether they used consistent eligibility criteria over time. The 2024 point-in-time estimates have their own limitations—notably, they include newer Universal programs that may not have reached their enrollment potential. For comprehensiveness, we provide estimates from both samples below.

Panel A of Figure 4 shows the enrollment rate for all 4-year-olds in state-funded pre-K programs based on NIEER annual reports. On average, among the 23 states with consistent eligibility criteria, those with Universal income eligibility enrolled a higher proportion of 4-year-olds in the population (49%,

compared to 26% in Targeted states in 2019), suggesting that states with no income requirements enrolled more children. This difference held when we examined all states, regardless of whether eligibility requirements were consistent over time. In 2024, among all 50 states, states with Universal eligibility enrolled 41% of children, and states with income-targeted eligibility enrolled 24%. Yet, as Panel A reflects, we observed considerable heterogeneity and overlap among Universal and Targeted states.

Unfortunately, NIEER data do not allow for disaggregation by family income; thus, we could not determine whether low-income families had greater access when eligibility was Targeted or Universal. To answer this question, we turned to the ACS, which annually surveys a nationally representative sample of households. The ACS asked parents to report their child's age and whether he/she was enrolled in *any* type of formal preschool. Consequently, an affirmative response could include enrollment in private centers not funded by public dollars or in federally funded Head Start. We used this more inclusive measure because many parents may not be aware of their child's preschool's funding structure. In addition, this measure allows us to understand how state funding decisions shape the entire market for pre-K enrollees at a given point in time.

As seen in Panel B, states with Universal income eligibility did not have substantially higher enrollment in any type of preschool from 2005 to 2019. In 2019, on average, Universal states enrolled 60% of their age-eligible children in some kind of preschool, compared to 59% in Targeted states. Using the 2024 data in isolation and including all 50 states, the pattern was similar: Universal states enrolled 57% of 4-year-olds, and Targeted states enrolled a slightly smaller share at 54%. Because the ACS data included sampling error (unlike the NIEER data, which captured a full population census), we tested the statistical significance of this difference: the 3 percentage-point difference was not statistically significant ($p = .26$).

What about enrollment of low-income children? Panel C shows enrollment patterns only for low-income respondents to the ACS (≤185% of the Federal Poverty Level). Overall, we found that among the 23 states with consistent criteria, those with and without income-eligibility requirements each enrolled approximately 45% of age-eligible low-income children over the 15-year panel; in 2019, Universal states enrolled 53% on average and Targeted states enrolled 49%. Among all 50 states in 2024, Universal states reached 45% of low-income 4-year-olds on average, compared to 47% for Targeted states, but this difference was not statistically significant ($p = .57$).

Finally, we investigated pre-K access for economically disadvantaged neighborhoods at the school level (Panel D). Using CCD data on school-based pre-K, we calculated the percentage of Title I elementary schools in a given state-year that offered a pre-K program. Although we observed a difference by state

program eligibility (74% in Universal vs. 71% in Targeted states in 2019), there was substantial variation across states, with several Targeted states consistently among the highest in the distribution. In 2024, rates were similar: 70% of Title I schools in Universal states offered a pre-K program, compared with 65% in Targeted states.

In the online supplement, we include more details about our efforts to reconcile enrollment patterns across the different measures, and also provide sensitivity checks on the analyses above using the more stringent definition of Universal pre-K (Table S9; Figure S5). In general, results were very similar when we restricted Universal status to states using age alone to determine eligibility.

Discussion

Since the turn of the 21st century, the United States has witnessed a substantial increase in state-funded public pre-K programs serving 4-year-olds. The expansion strategies taken by states reflect long-standing debates in the ECE literature over the best ways to prioritize program funding. Given resource constraints, should programs prioritize quality for enrolled children or expand access? Should programs target their efforts to reach children living in poverty, or should pre-K operate as a broader entitlement for families across income levels?

This study examined how states have approached these questions over the past two decades, documenting growth in investment alongside heterogeneity in resource allocation. We compiled a new, state-by-year dataset of pre-K investment and enrollment (SPEND), tracked key metrics over time across states, and identified distinct pathways by which states have served their children and families through state-funded pre-K.

Although pre-K spending across the country has grown substantially since 2002, this growth has largely been driven by a relatively small group of states. A total of 18 “High Growth” states exhibited a clear rise in investment per 4-year-old, while most other states had relatively stable spending levels.

What accounts for these differences in state pre-K investment? They likely arise from both state-specific contexts and strategic advocacy efforts (Kirp, 2007). Yet, our results suggest that one cannot easily characterize pre-K expansion as a phenomenon driven by states that meet a particular political or demographic criterion. This finding does not imply that state characteristics are irrelevant to pre-K investment, but rather highlights that expansion might have been idiosyncratically shaped by varied political, economic, and institutional processes in individual states. Other work on the adoption of state pre-K, for instance, does suggest the political context plays a role (Cohen-Vogel et al., 2022; Curran, 2023). Such variation creates analytic opportunities to examine how these differences in investment and design across states may contribute to heterogeneous child impacts.

States also varied widely in how they allocated resources, adopting fundamentally different strategies to balance per-child investment and program reach. This is likely not surprising to anyone following ECE policy: state pre-K has long been characterized as a wide array of policies and designs across the country. Still, the magnitude of these differences—and the broader patterns they reveal—warrant consideration. Examining trajectories of per-slot spending and enrollment over time, increases in investment appear to be driven almost entirely by enrollment growth, suggesting that as spending increases, funds are primarily allocated toward serving more children.

A key motivation of this synthesis of investment patterns was to discern whether, across these unique expansion trajectories, a tradeoff emerged in how resources were allocated—either toward enhancing quality through higher per-slot investment or toward expanding access to a larger share of age-eligible children. Much of the work on publicly funded pre-K has debated whether scale-up of programs dilutes quality (e.g., Zigler et al., 2011). We asked a simple question: Do increases in enrollment predict reductions in state pre-K spending per slot? We found no evidence of such a tradeoff—increases in enrollment were not associated with systematic declines in per-slot investment, suggesting that, on average, states have been able to expand access without eroding spending levels tied to program quality. Instead, we observed a 21% increase in per-pupil spending for 4-year-olds. For context, per-pupil spending in K-12 increased by 34% over a similar period (Smith & Campbell, 2025).

Next, we probed another longstanding debate that has been central not only to public pre-K, but to program design across a wide range of social policies: eligibility and access. ECE experts continue to investigate and weigh the benefits of targeting pre-K programs through means-testing, with some arguing that Universal eligibility offers greater reach to vulnerable populations, greater political viability, and enhanced benefits for disadvantaged children by exposing them to more advantaged peers (Barnett, 2010; Kirp, 2007). Cascio (2023) reported that the effects on child test scores at the end of preschool were significantly larger for Universal programs compared with Targeted programs. Yet the theorized mechanisms for these effects remain underexplored.

A relevant and more basic question, then, is whether Universal programs fulfill their most fundamental intentions: serving more children overall, and more children from low-income families. While many states adopt models that enable participation by all age-eligible children regardless of family income, these programs may not achieve true Universal reach due to capacity/budget constraints or other limitations. Stepping back to examine patterns of access by program eligibility, our findings suggest that offering Universal rather than Targeted programs typically yielded higher enrollment rates in the state programs

themselves. However, average state pre-K enrollment among Universal states remains low relative to the presumed goal of 100% reach.

Interestingly, these advantages did not necessarily translate into the same level of ECE access across the population, as measured by any kind of preschool enrollment (i.e., the "extensive" margin). States had similar 4-year-old enrollment rates in any kind of formal preschool, regardless of whether the state offered a Universal or Targeted program (observed differences were small and not statistically significant).

On the one hand, these findings suggest that Universal eligibility did not lead to children from lower-income families becoming "crowded out" of the ECE marketplace by higher-income families. Indeed, enrollment rates of low-income students in both Targeted and Universal states appear to be relatively comparable to those of all 4-year-olds. However, increased access to Universal programs seemed to affect enrollment only at the "intensive" margin—parents shifting from private to public preschool—because enrollment in any kind of formal preschool has not changed over time (Figure 4, Panel B). The implications of this shift—for children's care quality, families' savings in child care costs, and ultimately child outcomes—remain largely unknown and warrant future research. The stable enrollment rate at the "extensive margin" during a period of substantial increases in public investment could also indicate that pre-K supply and demand have largely reached a point of equilibrium, with additional investment just shifting the type of care chosen by families who would have enrolled in some kind of care regardless of the public investment. This also warrants further research.

The patterns observed here also reflect broader trends in welfare and education program rollouts across the U.S. policy landscape. Across policy domains such as health insurance, nutrition assistance, and income support, scholars have emphasized that take-up of services among eligible populations remains a significant barrier to program success, with many arguing that universality may reduce stigma, administrative burden, and informational barriers that often suppress take-up among eligible low-income families (Currie, 2004; Ko & Moffitt, 2022). In this sense, state pre-K offers a useful case through which to examine how eligibility rules interact with investment decisions to shape both reach and equity, contributing descriptive evidence about how best to structure public programs.

Limitations

Our work is not without limitations. We did not endeavor to estimate program impacts, but the field needs a better understanding of the sources of program heterogeneity that can drive positive outcomes for children. Our descriptive study is limited to the years and measures included in NIEER. A significant amount of pre-K scale-up occurred in the years preceding NIEER's data collection; we report only on the past 23 years, a period of increased

attention to ECE. We also used relatively simple analyses to present the data in a straightforward manner. For example, when determining categories of state spending over time, we opted for conceptually driven coding rather than a data-driven approach (e.g., latent class analysis). However, the categories were intended merely to make the data easier to describe, and the basic inferences from models predicting group membership were largely upheld by our model using the continuous measure of spending. In addition, our measure of state pre-K investment was limited to spending on 4-year-olds in a single year. Because many states also provide programs for 3-year-olds, their contributions were underrepresented in our figures and analyses.

Conclusion

We documented the scale-up of public pre-K in the U.S. over the past two decades. The value of our study, we believe, lies in its ability to help policymakers and scholars situate specific research questions and findings within the broader landscape of pre-K investment across the United States. As ECE researchers continue to pursue ambitious agendas around the impacts of state-funded pre-K, this descriptive documentation can complement ongoing evaluation work by clarifying how states have structured and scaled their investments in the modern era of public pre-K.

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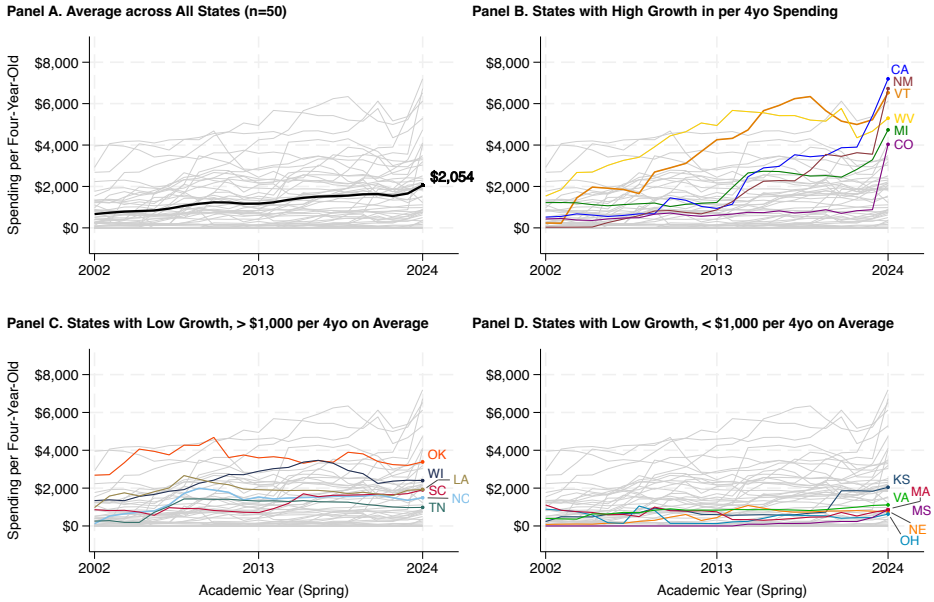
Figure 1. How have state investments in total pre-k spending per child in the state changed over time? State pre-k spending per 4-year-old in the population



Note. Spending was adjusted to 2024 dollars. "Spending per 4-year-old" was calculated by dividing total state pre-k spending by the total number of 4-year-olds in the state population, then multiplying by the proportion of children enrolled who were 4 years old. In all panels, gray lines represent states (n = 50 in each). Panel A shows the unweighted average ($2,054 in 2024). Panels B through D show exemplar states of each "spending trajectory" category (coded by the research team), highlighting states with the largest ranges in per 4-year-old spending (within each group) across all years.

Table 1. Associations between average state characteristics and membership in state pre-k "spending trajectories"

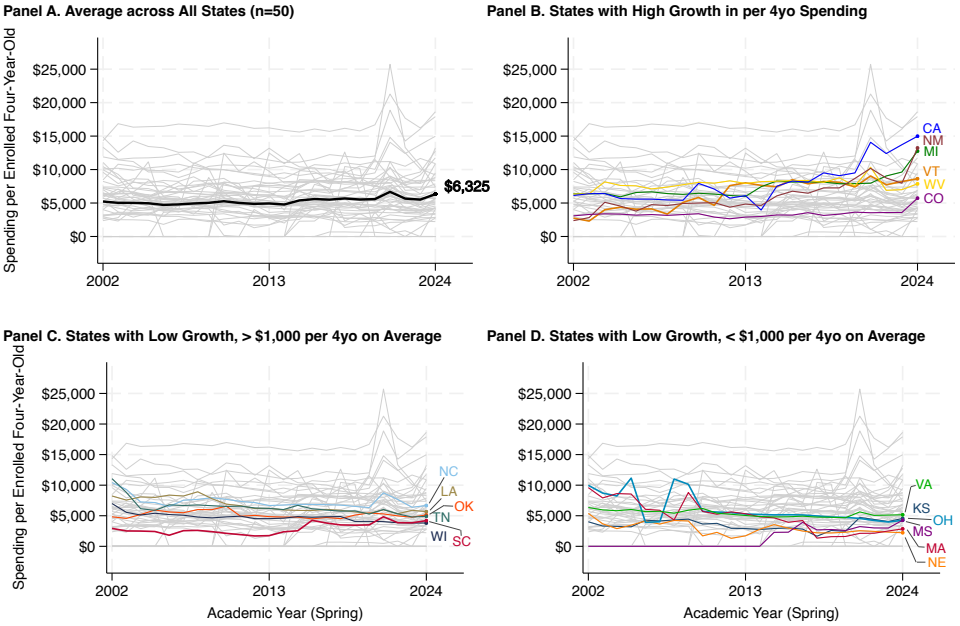
	High Growth	**Low Growth, >$1K Avg.**	**Low Growth, <$1K Avg.**	**No Program**	**Avg. Sp. per 4yo ($)**
Population (tens of millions)	0.15	-0.13	0.01	-0.02	550.20
	(0.13)	(0.13)	(0.13)	(0.10)	(376.77)
3yo and 4yo pop. (pp)	-0.75	-0.50	0.83	0.42	-1760.60
	(0.73)	(0.61)	(0.70)	(0.45)	(1942.88)
Black child pop. (10 pp units)	0.30	-0.14	-0.15	-0.01	59.14
	(0.15)	(0.14)	(0.17)	(0.10)	(390.33)
Hispanic child pop. (10 pp units)	0.16	-0.05	-0.08	-0.03	-29.62
	(0.11)	(0.09)	(0.16)	(0.07)	(241.74)
GSP per capita ($10,000 units)	-0.39**	0.25**	0.12	0.01	-317.25
	(0.12)	(0.08)	(0.15)	(0.09)	(277.43)
State min. wage ($)	0.13	-0.10	0.01	-0.05	163.95
	(0.10)	(0.09)	(0.12)	(0.07)	(281.37)
Unemployment rt. (pp)	-0.25	0.22	0.17	-0.14	-233.82
	(0.16)	(0.15)	(0.17)	(0.09)	(417.61)
Employment rt. among women (pp)	-0.08	0.11*	0.00	-0.04	-7.66
	(0.05)	(0.04)	(0.04)	(0.03)	(128.56)
Child poverty rt. (pp)	-0.06	0.06*	-0.01	0.00	27.74
	(0.04)	(0.03)	(0.06)	(0.04)	(86.53)
Avg. welfare rt. (pp)	0.11	0.04	-0.12	-0.03	-206.72
	(0.13)	(0.12)	(0.11)	(0.07)	(349.37)
NSLP participation (pp)	0.01	-0.01	0.02	-0.01	41.41
	(0.03)	(0.02)	(0.03)	(0.02)	(47.44)
SBP participation (pp)	-0.05	0.04	0.03	-0.03	131.27
	(0.05)	(0.04)	(0.04)	(0.03)	(92.81)
Gov. is democrat (1=yes)	0.53*	-0.03	-0.32	-0.18	941.81
	(0.25)	(0.24)	(0.42)	(0.21)	(585.47)
Avg. fraction democrats in state leg.	-0.00	-0.17	0.89	-0.72	745.03
	(0.84)	(0.60)	(1.22)	(0.57)	(1964.82)
Total women in office (10 pp units)	0.13	-0.38*	0.25	-0.01	-169.73
	(0.16)	(0.14)	(0.27)	(0.14)	(630.13)
Head Start enrl. per 4yo (10 pp units)	-0.01	-0.22	0.01	0.22	-453.13
	(0.18)	(0.15)	(0.28)	(0.17)	(560.05)
CCDF participation per 4yo (10 pp units)	0.39	-0.66	0.21	0.06	-650.60
	(0.56)	(0.49)	(0.87)	(0.41)	(1333.19)

Medicaid sp. per capita ($10,000 units)	0.40	-0.95*	0.41	0.13	-1491.54
	(0.48)	(0.38)	(0.55)	(0.35)	(1093.03)
Adjusted cohort grad. rt. (10 pp units)	0.11	0.01	-0.15	0.03	-381.77
	(0.27)	(0.24)	(0.31)	(0.16)	(882.32)
K-12 PPE ($10,000 units)	0.38	-0.08	-0.21	-0.09	2451.71*
	(0.41)	(0.25)	(0.36)	(0.19)	(1024.20)
K-12 enrollee pop. (pp)	0.14	0.07	-0.10	-0.10	488.02
	(0.12)	(0.10)	(0.13)	(0.07)	(311.28)
Infant mortality (pp)	-0.09	0.00	0.22	-0.13	-77.64
	(0.16)	(0.14)	(0.16)	(0.14)	(445.20)
Youth in juvenile detention (per 1,000)	0.41**	-0.35**	-0.09	0.03	-76.75
	(0.14)	(0.12)	(0.17)	(0.09)	(375.66)
Constant	5.78	-8.23	-2.94	6.39	-540.27
	(5.13)	(4.59)	(6.09)	(4.02)	(12756.67)
Observations	50	50	50	50	50
R-squared	0.63	0.63	0.32	0.66	0.66

* $p < .05$, ** $p < .01$, *** $p < .001$

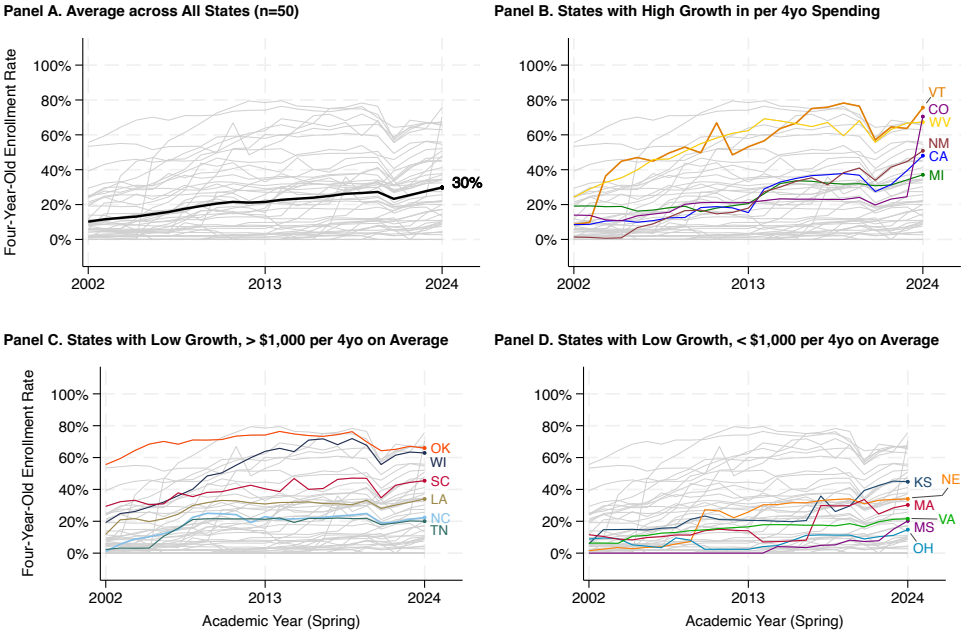
Note. Results are shown for four linear probability analyses predicting states' membership in state pre-k spending trajectories, using average state characteristics across years. The last column shows partial associations between each state characteristic and the average state pre-k spending per 4-year-old (i.e., averaged across academic years 2002-2024). Thus, each column represents results from a single regression model in which the variable listed in the top heading (e.g., high growth binary indicator) was regressed on all of the variables listed in the first column. Robust Standard Errors are in parentheses. avg.=average, K=thousand, yo=year-old, pop.=population, pp=percentage points, GSP=Gross State Product, min.=minimum, rt.=rate, NSLP=National School Lunch Program, SBP=School Breakfast Program, gov.=governor, enrl.=enrollment, leg.=legislature, CCDF=Child Care and Development Fund, sp.=spending, grad.=graduation, PPE=Per Pupil Expenditure.

Figure 2. How have investments in pre-k quality changed over time?
State pre-k spending per enrolled 4-year-old



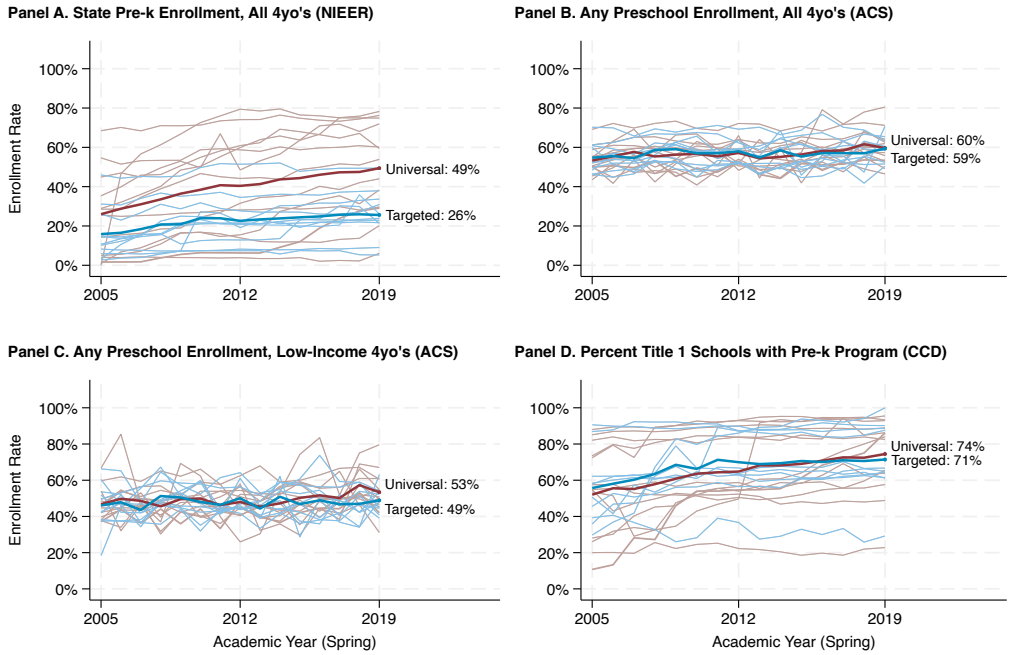
Note. Spending is adjusted to 2024 dollars. "Spending per Enrolled 4-year-old" was calculated by dividing spending by the number of enrolled 4-year-olds for a given year, then multiplying by the proportion of children enrolled who were 4 years old. In all panels, gray lines represent states (n = 50 in each). Panel A shows the unweighted average ($6,325 in 2024). Panels B through D show exemplar states of each "spending trajectory" category (i.e., depicted in Figure 1; coded by the research team), selected for having the largest within-group ranges over time. Note that the spike in per-child expenditure observed in 2021 is likely an artifact of enrollment drops due to COVID.

Figure 3. How have enrollment rates changed over time?
Enrollment rate of all 4-year-olds



Note. The enrollment rate of all 4-year-olds was calculated by dividing the total number of 4-year-olds enrolled (reported by administrators via NIEER annual reports) by the population of 4-year-olds in the state. In all panels, gray lines represent states (n = 50 in each). Panel A shows the unweighted average enrollment rate (30% in 2024). Panels B through D show exemplar states of each "spending trajectory" designation (i.e., depicted in Figure 1; coded by the research team), highlighting states with the largest ranges in per 4-year-old spending (within each group) across all years.

Figure 4. Do enrollment rates differ across universal and targeted programs?
Preschool enrollment rates of all v. low-income 4-year-olds by income eligibility (n = 23 states)



Note. Graphs above plot individual- and school-level access for different preschool types, data sources (NIEER, ACS, CCD), and populations (all 4-year-olds, those from low-income families). "Low-income" ≤ 185% of the Federal Poverty Level. Included states had consistently Universal (n = 13) or Targeted income eligibility (n = 10) from 2005-2019 (see Supplement for details). Thick lines represent unweighted averages across states in each group, and label averages in 2019. NIEER=National Institute of Early Education Research, ACS=American Community Survey, CCD=Common Core of Data.

Supplementary Materials for
23 Years of State Pre-K Expansion: How States Balance Investment, Access, and Quality in the Modern Era

Additional Methodological Information

Data

The state-by-year state pre-K spending, enrollment, and income eligibility data for this project were provided by the National Institute for Early Education Research (NIEER), which has collected and reported on each state's pre-K program(s) annually since 2002 (i.e., 2002 to 2024). Raw spending and enrollment data were at the state level, and income eligibility data were at the program level when shared (see more details on how we aggregated to the state level below). NIEER collected these data via annual surveys to state-level early childhood education administrators, instructing each state office to report the total pre-K expenditures for the relevant academic year. The dataset included the annual spending level by funding source (state, local, federal), as well as the level of program enrollment and the state population by age based on U.S. Census data (3-year-olds and 4-year-olds). To be included, programs must have been funded and managed by the state (therefore excluding city- or locally funded programs, unless those programs operated as part of the state-funded system), serve children at ages 3 or 4, and have a primary focus on providing early childhood education (ECE) in a group-based setting at least 2 days per week. Although the dataset contained program enrollment by age (i.e., separate enrollment figures for 3- and 4-year-olds, respectively), total state-funded pre-K expenditures represented any services offered to 3- or 4-year-old children. As we describe in more detail below, we use these data to generate several measures of state pre-K investment and reach, which for the purpose of our analyses, we limit to 4-year-olds.

Time-varying state characteristics were collected from a set of publicly available state-by-year datasets: University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data, Michigan State University (MSU) Correlates of State Policy, Urban Institute Welfare Rules Database, Center for American Women in Politics (CAWP), Center for Medicaid & Medicare Services (CMS), Kids Count data from the Annie E. Casey Foundation, Administration of Children and Families (ACF), American Community Survey (ACS) data from the Integrated Public Use Microdata Series (IPUMS), Common Core of Data (CCD) from the National Center for Education Statistics (NCES). From these sources, we constructed a state-by-year dataset that included a variety of additional policy-relevant variables, including economic indicators, demographic composition, welfare use rates, and political majorities. These data defined "year" in different

ways, which needed to be reconciled to merge datasets. For the education-based data, we simply merged by state and academic year (Common Core and NCES). The other datasets, rather, reported on a "calendar year" basis; for these, we aligned each calendar year of the state characteristics data with the beginning of each school year in the pre-K data (e.g., state characteristics from calendar year 2023 aligned with academic year 2023-2024).

Lastly, we also incorporated aggregated individual-level enrollment data from the American Community Survey (ACS) on family income and child pre-K enrollment to generate state-by-year estimates of enrollment rates among low-income families. The ACS is a nationally representative household survey that collects data from approximately 3.5 million households each year, collecting parent-reported data on family income and school enrollment continuously throughout the year. To integrate these data, we restricted the sample to children reported as 4 years of age in the relevant state-year (n = 731,050; by state, observations range from 1,461 in Vermont to 86,445 in California). We aligned "calendar year," denoted by the year of data collection, with the spring of the academic year in our pre-K data (e.g., ACS enrollment reported in 2024 aligned with pre-K characteristics from the academic year 2023-2024). Note that because ACS is collected throughout the year (i.e., not limited to a single time of year), with no publicly released indication of the survey date, aligning the calendar year and the academic year is imprecise for all children, but we believe it is still reflective of broad state-by-year enrollment trends. All variables generated using these data (expanded upon below) were weighted using the person weights reported in the ACS (see full list of raw variables drawn from the ACS in Table S2 and steps taken to generate new variables in Table S3).

We compiled these data to generate a new, state-by-year dataset on 21st-century pre-K scale-up, State Pre-K Expenditures: A National Dataset (SPEND), which will be publicly released upon publication of the peer-reviewed article.

Measures

A full list of variables used across all analyses, including their respective sources and any calculations made to generate them, can be found in Table S1.

State Pre-K Spending

State Pre-K Spending per 4-year-old. The main expenditure variable of interest is state spending on pre-K. This figure was adjusted for inflation via the Consumer Price Index to 2024 dollars. It includes funding from state sources only, as reported by state administrators, rather than local or federal sources, which can be difficult and somewhat arbitrary to report. For the current study, we followed the distinctions made by NIEER, which attempted to isolate pre-K spending specifically from state-generated sources (e.g., state lotteries, sales tax, school funding formulas). For example, respondents were instructed to exclude funding from Title I, Individuals with Disabilities Education Act (IDEA), Head

Start, and Child Care and Development Fund (CCDF), although it is possible that funding from these sources could be inadvertently reported in the state spending figure, as the braiding of these sources is complex and difficult to track. These sources are captured in another total pre-K spending figure reported by NIEER—"All Reported Spending", which includes federal and local funds allocated to states' pre-K programs (that states can report) in addition to those sourced from the state. Because the degree to which states reliably report funding allocated to pre-K from federal and local sources varies strongly, we focus on *state* pre-K spending as the most consistent indicator of state investment in public pre-K.

We recognize that some state funding policies require a local match, but such a match is typically a downstream consequence of state funding policy. Other consequences of state funding also surely ensue, such as family and philanthropic contributions. Our focus is not on the total amount of financial resources for pre-K, but rather on the cross-time patterns of state funding only, predictors of state funding levels, and consequences of state funding levels for population and subgroup reach.

To generate a figure of state pre-K investment that is comparable across states and years, we scaled total pre-K spending by the 4-year-old population (targeting 4-year-olds remains the primary focus of most programs—in 2024, the enrolled pre-K population was 80% 4-year-olds on average, ranging from 40-100% across states). However, to account for expenditures allocated to slots for 3-year-olds in some programs (i.e., not directed toward 4-year-olds), we then multiplied the spending figure by the proportion of children served who were 4 years old. "State pre-K spending" can therefore be interpreted as the level of funding allocated to state-run pre-K for any given 4-year-old in the state, regardless of whether they attend.

State Pre-K Spending per Enrolled 4-year-old. To calculate how each state allocated funding to each 4-year-old *enrolled* in a given year (i.e., spending per pupil or slot), we divided total state pre-K spending by the number of 4-year-olds enrolled, then multiplied by the proportion of enrolled children who are 4 years old. We refer to this figure as "per-pupil expenditure" or "per-slot spending" throughout this study to indicate that it represents the level of investments states have made in a given pre-K slot, and thus delineate it from the general "state pre-K spending" variable, which is instead scaled by the total population of 4-year-olds in a state-year.

Pre-K and ECE Enrollment and Access

Several different data sources and "enrollment rate" variables were used to describe various dimensions of access to state pre-K and preschool more broadly. For the most basic form of state pre-K access, we start with NIEER's administrative data on enrollment in the state-funded pre-K program we report on in this paper. Because the NIEER data do not include any additional

characteristics of pre-K enrollees and are not disaggregated by income, we then turned to two alternative sources: the ACS household survey (obtained via the Integrated Public Use Microdata Series; Ruggles et al., 2025) and the CCD repository for school-level data (U.S. Department of Education, National Center for Education Statistics, 2024). Below, we report the purpose of including each of these variables and the steps that were taken to generate them. We also provide more details on our use of the ACS, including the specific items used and the calculations performed, in Tables S2 and S3.

State Pre-K Enrollment Rate (NIEER). To calculate the percentage of all 4-year-olds in the state who were enrolled in state-funded pre-K, we divided the number of 4-year-olds enrolled in state-funded pre-K (from NIEER; recall that this excludes locally funded programs) by the total 4-year-old population, which NIEER obtained from the U.S. Census. We then multiplied by 100 to express this figure as a percent. Four-year-old enrollment rate thus represents the overall reach of a state's pre-K program(s) in relation to the entire 4-year-old population.

Preschool Enrollment Rate of All and Low-Income Children (ACS). Next, we drew from the ACS a measure of enrollment in *any* type of preschool/ECE. This set of measures serves two purposes. First, because it may be challenging for parents to distinguish among the complex funding sources for children's pre-K programs, survey items about any type of preschool enrollment could be more reliable. Second, this variable reflects overall access to any kind of formal preschool program. Therefore, examining this measure addresses the broader question of how state pre-K program funding relates to overall participation in preschool.

To calculate these variables, we generated a weighted estimate of 4-year-olds enrolled in any preschool (public or private) per state-year, then divided this estimate by the total number of 4-year-olds per state-year. We also calculated the equivalent measure for low-income families: we generated a weighted estimate of low-income 4-year-olds enrolled in any preschool per state-year, then divided this estimate by the total number of low-income 4-year-olds per state-year. We defined "low-income" as those whose family income, reported as a percent of the Federal Poverty Level (FPL) in the ACS, fell at or below 185% of the FPL. This threshold was selected because it corresponds to the cutoff for free or reduced-price meals in public schools.

See Tables S2 and S3 for more details on the specific raw variables extracted from the ACS and steps taken to calculate the generated measures.

Availability of Pre-K at Title I Schools (CCD). Finally, we used the CCD to generate a measure of pre-K access in high-poverty areas at the school level. CCD reports enrollment at the school/grade level. Using these data, we first identified schools that qualify for Title I funding by flagging those for whom 40% or more of their students received Free or Reduced-Price Lunch. We then

aggregated a sum of total Title I elementary schools and Title I elementary schools with a pre-K program to the state-year level. We divided the latter by the former to generate a percentage of Title I schools in a given state-year that offered a pre-K program.

State Pre-K Spending Trajectories by State

To examine how states may select into different spending trajectories, we coded each state into one of four groups using the "State pre-K spending per 4-year-old" variable: "High Growth" (n =18), "Low Growth/ Higher Spending" (n = 11), "Low Growth/ Lower Spending" (n = 13), and "No Program" (n = 8). These categories were manually created based on visually observing state pre-K spending trajectories for each state over the full panel. Using figures on states' spending trajectories, two independent coders categorized each state. Discrepancies (5 in total) between the two coders were resolved via discussion among the full project team. Individual state spending trajectories used to code these categories, grouped by the categories they were assigned to, are shown in Figure S2.

State Policy for Means-Tested Versus Universal Pre-K Eligibility

To determine the scope of income-eligibility criteria that were used throughout the state, we first coded at the program level to indicate whether a given program within a state/ year had targeted or universal income eligibility. We defined a "Targeted" program as one that had some income threshold that must be met for enrollment. We also categorized programs as Targeted if they used family income to prioritize attendance (e.g., in Connecticut's Child Day Care Contracts program, 60 percent of families must fall under 75 percent of the State Median Income). Alternatively, "Universal" programs were those that did not impose any income-based eligibility criteria.

Although income was the most common eligibility criterion beyond age (i.e., most pre-k programs are reserved for 4-year-olds), some states included other factors that gave certain children priority for enrollment. It is difficult to know from the policy descriptions alone whether these states intended to have "universal" eligibility. For our main categorization, we included states in our "universal" category that had no income requirements, even if they did take other factors into account when determining enrollment (e.g., homelessness, child disability, or parent education level). However, we also tested a more restrictive definition of "universal" that included only states with age as the sole eligibility requirement.

With this more restrictive category, we again coded at the program level first, flagging those that reported any type of requirement or prioritization of families' enrollment based on child or household characteristics (e.g., disability, homelessness, parental education). This also included indications that eligibility criteria were "locally determined." Programs with no eligibility criteria beyond

age were flagged as Universal programs under this alternative definition. As before, we aggregated at the state level by flagging whether a state had any program that met this definition of universal in a given year. We used this more stringent definition of Universal to test the sensitivity of our figures and analyses, expanded upon below.

After coding at the program level, we developed a state-level binary measure of whether or not a state-year had at least one program that had no eligibility requirements based on income (1= state-year has at least one universal pre-K program, 0= state-year does not have any universal pre-K program). Figure S1 shows the portion of states in each category, out of the total states with a pre-K program for each year of our panel. For the purpose of this paper, we use shorthand terms Universal and Targeted to indicate states that *do* have at least one program with no income requirements, versus those whose program(s) all have some income requirement, respectively. Note that because these designations were strictly based on the state pre-K eligibility criteria in each state-year, actual enrollment rate of the programs do not factor into them. States that met the Universal distinction under this definition in 2024, for example, ranged from 4.6% of 4-year-olds enrolled in Hawaii to 75.6% in Vermont.

In our figure presenting enrollment rates by program model for a subset of states with consistent income eligibility criteria from 2005 to 2019 (Figure 4 in the main text), Universal states included Alabama, Florida, Georgia, Maine, Missouri, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Vermont, West Virginia, Wisconsin; Targeted states included Colorado, Connecticut, Delaware, Illinois, Maryland, Nebraska, North Carolina, Tennessee, Texas, Washington. Note that these categorizations may no longer apply to the same states if they have shifted their income eligibility model between 2020 and the present day (e.g., Colorado began a universal program in the 2023-24 school year). Note that we include Florida in this group and relevant analyses even though it started its program in the 2006 academic year (and is thus missing for 2005).

State Characteristics

State-by-year state characteristics were sourced from the University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data set; the Michigan State University Institute for Public Policy and Social Research (IPPSR); the Center for American Women and Politics (CAWP); the American Community Survey (ACS); and the Common Core of Data (CCD). From each of these sources we selected relevant policy, economic, demographic, and political indicators (the full list will be available at an online repository, still under construction). Where appropriate, we generated new variables by scaling raw values from the above data sources with either the total state population or the

population of the relevant eligible populations. Number of children 0-5 with at/below 130% FPL was divided by the number of children aged 0-5; Number of SSI Recipients, SNAP Recipients, TANF Recipients, and Medicaid Beneficiaries were divided by total population; Number of WIC Recipients was divided by the number of women aged 15-50 plus the number of children aged 0-5; Number of NSLP Recipients and SBP Recipients were each divided by the number of individuals in the state aged 18 and under. All population values were obtained from census data via IPUMS. In the case of ACS, from which we acquired racial composition variables, we generated weighted estimates of the percent of children and adults in the state for each racial category using person weights from the ACS.

In addition, where appropriate, we created composite values of related variables to more broadly represent these indicators in our analyses: recipient rates for Medicaid, Medicare, SNAP, AFC/ TANF, and SSI were averaged to generate an overall welfare recipient rate; the fraction of the state house that were democrat and the state senate that were democrat were averaged to create an overall fraction of the state legislature that is democrat.

Because Nebraska has a unicameral state legislature, data on the proportion of legislators who were Democratic were unavailable. To retain Nebraska in the state-level analyses of all 50 states, we mean-imputed this variable for Nebraska in each year.

To analyze the relation of these variables to state pre-K investment, we created state averages across all years in the panel (2002 to 2024).

For a supplemental analysis, we also integrated state-year academic achievement data from the publicly available National Assessment of Educational Progress (NAEP) dataset (National Center for Education Statistics, 2025). The NAEP includes a math and reading assessment administered in grades 4 and 8 to a representative sample of students from each state every two years (between January and March of each testing year), and is designed to be comparable over time and grades. NAEP data were aligned with the following year of state pre-K spending for the purpose of our analyses (e.g., NAEP scores from the Spring of 2023 aligned with academic year 2023-2024 in our state pre-K spending data; see analysis details below).

Coding of State Pre-K Spending Trajectories

As detailed above, we categorized states into one of four groups of "spending trajectories," based on each state's inflation-adjusted spending trajectory per 4-year-old over the entire 23-year panel. Two members of the research team independently and manually reviewed individual figures showing spending per 4-year-old over time for all 50 states (see Figure S2). First, after reviewing figures of each state's trajectory, the first author established appropriate groups to categorize the states. During this process, the first author identified a

substantive difference among states that, throughout the panel, did not significantly increase their pre-K spending—some maintained very low levels of spending, whereas others consistently spent over $2,000 per 4-year-old in the state's population. Thus, we created four possible categories that characterized different patterns of pre-K spending: "High Growth," "Low Growth/ Higher Spending," "Low Growth/ Lower Spending," and "No Program." Using these established categories, the first and second authors, again strictly visually, then independently reviewed and coded each state. We identified discrepancies between us (five states) that were then discussed and resolved with the larger author team.

To more systematically distinguish between the "Low Growth/ Higher Spending" and "Low Growth/ Lower Spending" categories, we reviewed each state's average per 4-year-old spending (i.e., across the entire 23-year panel). We found that $1,000 per 4-yo, on average, was a rational cutoff for dividing these two groups to be reasonably balanced, and recategorized states accordingly. "No Program" states have either never had a pre-K program or have had periods of spending limited to less than half of the panel, most of which occurred in the middle of the panel (with North Dakota being the exception).

According to the codes established, "High Growth" states included: Alabama, Arkansas, California, Colorado, Florida, Iowa, Maine, Maryland, Michigan, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, Washington, and West Virginia (n =18). "Low Growth/ Higher Spending" states included: Connecticut, Georgia, Illinois, Kentucky, Louisiana, North Carolina, Oklahoma, South Carolina, Wisconsin, Tennessee, and Texas (n = 11). "Low Growth/ Lower Spending" states included: Alaska, Arizona, Delaware, Hawaii, Kansas, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, Nevada, Ohio, and Virginia (n =13). "No Program" states included: Idaho, Indiana, Montana, New Hampshire, North Dakota, South Dakota, Utah, and Wyoming (n = 8). To make these distinctions clear, we specify in tables and figures that "Low Growth/ Higher Spending" states spend greater than $1,000 per 4-year-old on average, and "Low Growth/ Lower Spending" states spend less than $1,000 per 4-year-old on average.

We examined whether these trajectories changed meaningfully when per-4-year-old spending was adjusted for state Cost of Living (COL). To do so, we integrated COL adjusters (or "Implicit regional price deflators") from the Bureau of Economic Analysis (BEA; *BEA Interactive Data Application*, n.d.), multiplying each state-year value (already inflation-adjusted to 2024 dollars) by its COL factor. As seen in Figures S3 and S4, we did not find a meaningful difference in the characterization of spending trajectories when adjusting for COL.

Reconciling Discrepant Enrollment Rate Estimates

It should be noted that each of the above enrollment rate sources and measures presents distinct limitations, making direct comparisons challenging. Because the NIEER enrollment data—reported annually by state administrators—do not include participant characteristics, we leverage the nationally representative ACS to examine enrollment by household income. However, the ACS only distinguishes preschool enrollment by sector (public vs. private), where "public" may include Head Start or locally funded programs in addition to state-funded pre-K. Moreover, parents who responded to the ACS may have had difficulty distinguishing among complex and overlapping early childhood program types, introducing additional measurement error (particularly for states with greater mixed delivery of pre-K). For this reason, we focus our main figures on enrollment in any type of preschool (public or private) when using ACS data.

Additional discrepancies may arise from differences in the timing and structure of data collection. NIEER reports enrollment aligned to the academic year (typically from a fall enrollment count) and based on administrative counts, whereas the ACS is collected continuously throughout the calendar year and does not include a precise measure of interview timing relative to the school year. As a result, ACS responses may reflect enrollment at different points in the academic cycle (e.g., summer months or transitions into kindergarten), which could attenuate or otherwise distort state-level estimates. In addition, NIEER counts children as 4 years old when they are eligible for Kindergarten the following year (thus, they could already have turned 5 at the beginning of the pre-K year). ACS, in contrast, reports the actual age of the child at the varying date of data collection (and, because survey date is not reported, we were not able to tie this to the school year/pre-K enrollment eligibility).

When comparing enrollment rates among all 4-year-olds across NIEER and ACS measures, we observed predictable differences (Figure S6; note that we also include here an ACS measure of "public pre-K enrollment" as a more comparable reference point to NIEER's state pre-K enrollment). At the national level (i.e., weighted by state population), however, the two sources track one another more closely over time, particularly in recent years (Figure S7). More importantly, while individual state trajectories often diverge—and in a small number of cases produce counterintuitive patterns, such as ACS "any preschool enrollment" estimates falling below NIEER-reported pre-K enrollment—the cross-state averages are highly similar across data sources (Figure S8). This pattern suggested to us that much of the discrepancy reflects idiosyncratic measurement noise at the state level rather than systematic bias.

We further assessed the validity of each of these enrollment measures in two ways. First, we generated comparable estimates of low-income 4-year-old enrollment in school-based pre-K using the CCD. Here, we observed similar patterns to those derived from NIEER (Figure S9, compared to Figure 4 panel C

in the main text). Second, focusing on states that newly adopt universal pre-K programs, we examine state pre-K enrollment trajectories relative to the year of adoption. As shown in Figure S10, enrollment rates increase sharply in the year of adoption, providing additional evidence that the measures capture meaningful policy-induced variation in access.

Analysis

RQ1: How has investment in state-funded pre-K changed over the last 23 years?

First, we visually described our main construct of interest, state pre-K investment. We plotted state pre-K spending for each of the 50 states over our panel from 2002 to 2024. Using these plots, we identified common patterns of spending trajectories (see detailed description of this process above). We averaged yearly state pre-K spending across all states to depict the cross-state, unweighted average of state pre-K investment over time. We then identified states with the largest range in state pre-K spending over time and highlighted them in each of our "spending trajectory" groups as exemplars of that spending pattern.

RQ2: Do state characteristics predict patterns of state pre-K spending?

Next, we analyzed the extent to which a comprehensive set of state characteristics explained the various expansion trajectories states have taken over the last 23 years. For these models, we used average values over the 23-year panel for each state-level predictor to examine correlates of our scale-up trajectory groups (i.e., "No Program", "High Growth", "Low Growth/ Higher Spending", "Low Growth/ Lower Spending"). In addition, we assessed associations between each of these variables and states' average per-4-year-old spending throughout the panel (i.e., averaged over 23 years; $n = 50$). We included robust standard errors in each of these analyses.

To further probe these selection models, we replicated the above analysis using baseline (2002) state characteristic variables to predict membership in each spending trajectory group (results of which can be found in Table S5). We also conducted a time-varying linear regression analysis, regressing each state's pre-K spending per 4-year-old on the previous year's state characteristics, with state and year fixed effects (Table S6). Lastly, we explored whether student achievement, operationalized as state-level NAEP scores, predicted state pre-K spending per 4-year-old in the following year (Table S10).

RQ3: Do states trade off between expanding access to more children and per-child expenditures?

We then investigated whether there was a tradeoff between the overall reach of state pre-K programs and the level of investment made in each slot in a given state-year. First, we replicated the process described in RQ1 to plot states' pre-K spending per child enrolled and 4-year-old enrollment rate over time. Again, for each of these measures, we created a yearly average across states (i.e., unweighted) to observe cross-state changes over time. In line with our process for

RQ1, we identified states with the highest range in each of these measures over the panel, and highlighted these exemplar states within each of our previously designated "spending trajectory" groups. We compared these basic patterns of per-pupil expenditures (i.e., an indicator of the level of investment in quality for each slot) and 4-year-old enrollment rates to describe how states were allocating their increased spending over time and whether this indicates a tradeoff between investment in a given slot and expanding access to more slots.

To investigate this tradeoff further, we conducted a basic OLS regression analysis that included state and year fixed effects, regressing 4-year-old per-pupil spending on 4-year-old enrollment rate (Table S7). This analysis allows us to control for both observed and unobserved characteristics within a single state or single year that could contribute to spending and/or enrollment patterns, thus better isolating exogenous variation in enrollment rate:

$$PPE_{it} = \beta_1 ER_{it} + \alpha_i + \pi_t + \varepsilon_{it}$$

Where PPE_{it} represents pre-K spending per 4-year-old child enrolled (i.e., "per-pupil expenditure") for state i in year t, and ER_{it} denotes enrollment rate among the entire 4-year-old population in a given state/ year. The α_i term represents a fixed effect for state, which captures time-invariant state characteristics, and the π_t is a fixed effect for academic year, which accounts for any shocks experienced across all states in a given year.

Following this analysis, we conducted a sensitivity check that removed the 2020-2021 academic year, which was heavily affected by COVID-19 (Table S8).

RQ4: How does reach vary across states with universal income eligibility versus those with means-tested programs?

Our last objective was to investigate the degree to which differences have emerged in patterns of reach between states that implemented a universal approach to income eligibility requirements, versus those that took a targeted approach by implementing income requirements for families to enroll (details on coding this variable and the final list of states included can be found above). To do this, we first identified a subset of 23 states that implemented consistent eligibility criteria from 2005 to 2019. We limited the sample in this way to observe how enrollment rates changed over time within a given program model and to maximize the number of states that could be included (in subsequent years, several states adopted a universal program). Among this select set of states, we compared markers of reach across states that implemented any Universal pre-K program and those that had only Targeted programs.

Among this set of 23 states, we plotted each enrollment rate measure from 2019, indicating their status as Universal or Targeted throughout this period of time. We also created yearly averages for each of these groups, taking the

unweighted mean of the Universal and Targeted groups and comparing these averages over time.

We supplemented these comparisons among the subset of 23 states with consistent eligibility criteria over time with a comparison between universal and targeted states in 2024 alone. That is, we averaged all states that met the definition of Universal and all states that met the definition of Targeted within 2024. We report these means as standalone statistics in the Results section for each enrollment rate measure described above.

For our two measures of enrollment rate that used ACS enrollment rate estimates, we also assessed the difference in the average enrollment rate between Universal and Targeted states in 2024. To test whether preschool enrollment rates differed significantly between universal and targeted states, sampling uncertainty from the American Community Survey (ACS) was incorporated alongside state-level enrollment variation. Because both the numerator and denominator of each state's enrollment rate are derived from the survey, we used the 80 person-level replicate weights provided by the ACS to compute a within-state sampling variance for each state-year, following the Census Bureau's successive difference replication (SDR) variance formula (IPUMS USA, n.d.). The standard error of the difference in mean enrollment rates between universal and targeted states was then constructed to reflect both this within-state ACS sampling variance and the variance in enrollment rates across states within each group. Because the within-state sampling variance is estimated from large ACS samples and was therefore treated as known, a z-test was used to evaluate the difference in mean enrollment rates between universal and targeted states in 2024, conducted separately for each outcome: any preschool enrollment among all four-year-olds and any preschool enrollment among low-income four-year-olds.

Because both NIEER’s enrollment rate for all 4-year-olds and the CCD data on pre-K offerings in schools are census counts reported by administrators (i.e., not estimates derived through sampling, as is the case in the ACS), these measures were not included in the significance testing.

Last, we replicated the above figures and analyses using a more stringent definition of Universal eligibility. Under this definition, states were considered Universal if they implemented no eligibility criteria or prioritization besides age. (See details on the eligibility criteria reported by states that resulted in a reclassification of the Universal v. Targeted distinction for our analyses in Table S9). This necessitated excluding four states previously designated as Universal: Maine, Missouri, New Mexico, and West Virginia. As shown in Figure S5, this reclassification yielded similar results, although state pre-K enrollment in Universal states increased slightly (Panel A).

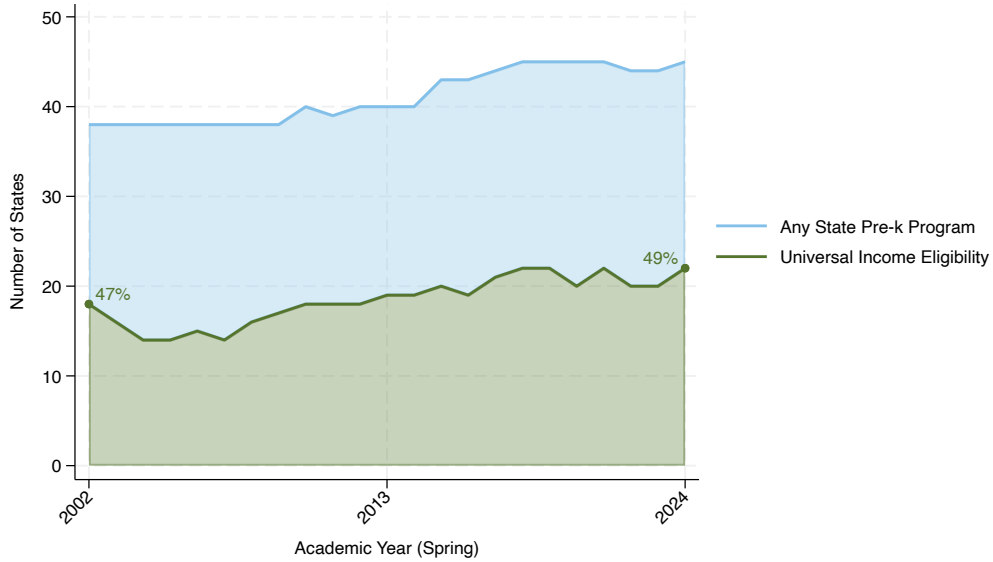
For our 2024 analyses, this alternative coding resulted in the reclassification of three states from Universal to Targeted: Maine, Mississippi,

and Washington. We found that with this more stringent definition of "Universal," results did not change. For NIEER's enrollment rate in state pre-k, we found that Universal states enrolled 43% of age-eligible children and Targeted states enrolled 25%. For the ACS measure of any type of preschool enrollment, we found that, on average, universal states enrolled 57% of all 4-year-olds and targeted states enrolled 55% of all 4-year-olds, resulting in a nonsignificant difference (p = .49). For preschool enrollment among low-income 4-year-olds, Universal states enrolled 44%, on average, and Targeted states enrolled 47%, resulting in a nonsignificant difference (p = .58). Finally, using the CCD data, we found that in Universal states, 70% of Title I schools had a pre-K program, and among Targeted states, 65% of Title I schools had a pre-K program.

AI Disclosure

ChatGPT (OpenAI, 2025) was used to refine analytical code and to make minor editorial improvements. All content was reviewed and verified by the authors.

Figure S1. States with Universal Income Eligibility by Year



Note. The above figure presents (1) the total number of states that have any stated-funded pre-K program, denoted by the blue line, and (2) the number of states that met our definition of Universal. In addition to the absolute number of states indicated on the y-axis, we label the percentage of states with a universal program out of the total with any program. States were coded as having Universal income eligibility when they had any state-funded pre-K program with no income requirements, and otherwise coded as Targeted. As indicated by the labels for the years at the beginning and end of the panel, 47% of states with any state pre-K program had Universal income eligibility in 2002, compared to 49% in 2024.

Table S1. List of all Variables and Sources

Variable	Original Source(s)	Calculation
State pre-K spending per 4yo	NIEER	(State pre-K spending /4yo population) * proportion of 4yo enrollees
State pre-K spending per enrolled 4yo	NIEER	(State pre-K spending /number 4yo enrollees) * proportion of 4yo enrollees
State pre-K 4yo enrollment (%)	NIEER	(Number 4yo enrollees / 4yo population)*100
Head Start enrollment (%)	NIEER	(Number 4yo HS enrollees/ 4yo population)*100
Any Preschool 4yo enrollment (%)	ACS	(4yos enrolled in any preschool/ total 4yos)*100
Any Preschool low-income 4yo enrollment (%)	ACS	(4yos w. household income <= 185% FPL enrolled in any preschool / Total 4yos w. household income <= 185% FPL) * 100
Title I schools with pre-K (%)	CCD	(Title I schools with pre-K/ total title I schools) * 100
CCDF participation rate (percent)	ACF	CCDF 4yo enrollment/ 4yo population
3yo and 4yo in population (%)	NIEER, UKCPR	(3yo and 4yo population/ total population)*100
Population (millions)	UKCPR	No calculation
Unemployment rate (%)	UKCPR	No calculation
Governor is Democrat (1=yes)	UKCPR	No calculation
Average fraction of democrats in state legislature	UKCPR	Mean of fraction democrats in state house, fraction democrats in state senate
Total women in office (%)	CAWP	No calculation
State minimum wage ($)	UKCPR	Adjusted to 2024 dollars
GSP per capita ($)	UKCPR	GSP/ population, Adjusted to 2024 dollars
Employment rate among women (%)	ACS	(Number of employed working age women with no children age-eligible for preschool/ total working age women with no children age-eligible for preschool)*100
Children 0-5 at/below 130% FPL (%)	UKCPR	(Number of children 0-5 with income 130% or below FPL/ Total number of children 0-5)*100
Avg. welfare recipient rate (%)	Urban Institute	Mean of WIC rate, SNAP rate, AFDC/TANF rate, Medicaid rate, SSI rate
Black child population (%)	ACS	(Weighted count of children that are non-Hispanic Black / weighted child population) * 100
Hispanic child population (%)	ACS	(Weighted count of children that are Hispanic / weighted child population) *100
Adjusted cohort graduation rate (%)	CCD	No calculation
K-12 per pupil	CCD	Adjusted to 2024 dollars

expenditure		
K-12 enrollment	CCD	No calculation
Infant mortality (%)	Kids Count	No calculation
Youth in juvenile detention (%)	Kids Count	No calculation
Medicaid spending per capita	CMS	Adjusted to 2024 dollars

Note. Above is the list of variables used in analyses with relevant source and calculation for each. yo=year-old; HS=Head Start, CCDF=Child Care and Development Fund, GSP=Gross State Product, FPL=Federal Poverty Level, NIEER=National Institute of Early Education Research, ACS=American Community Survey, CCD=Common Core of Data, ACF=Administration for Children and Families, UKCPR=University of Kentucky Center for Poverty Research, CAWP=Center for American Women in Politics, WIC=Women, Infants, and Children, CMS=Center for Medicaid and Medicare, SNAP=Supplemental Nutrition Assistance Program, AFDC=Aid to Families with Dependent Children, TANF=Temporary Assistance to Needy Families, SSI=Supplemental Security Income. All data was state-by-year with the exception of the ACS (individual-level, weighted using person weights to aggregate to state-year level), and CCD (school-level). See more details on construction of these variables above. Where variables are re-scaled for interpretation, we note how this is done as needed in each results table.

Table S2. List of Raw Variables and Corresponding Survey Items/ Description from the ACS

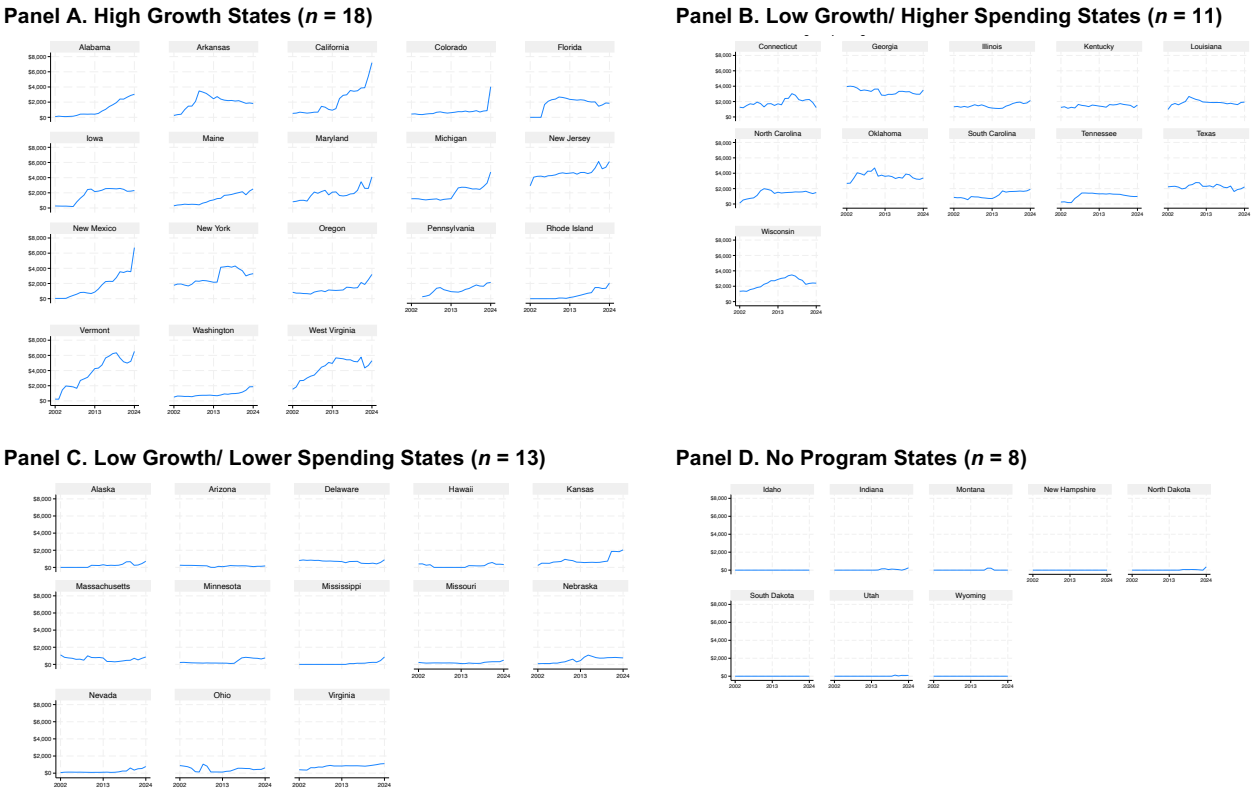
Raw Variable (IPUMS)	Original Survey Item or Description
schltype	10. a. At any time IN THE LAST 3 MONTHS, has this person attended school or college? Include only nursery or preschool, kindergarten, elementary school, home school, and schooling which leads to a high school diploma or a college degree. [] No, has not attended in the last 3 months — SKIP to question 11 [] Yes, public school, public college [] Yes, private school, private college, home school
gradeattd	b. What grade or level was this person attending? Mark (X) ONE box. [] Nursery school, preschool [] Kindergarten [] Grade 1 through 12 — Specify grade (e.g., 1–12) [] College undergraduate years (freshman to senior) [] Graduate or professional school beyond a bachelor's degree (for example: MA or PhD program, or medical or law school)
perwt	How many persons in the U.S. population are represented by a given person in sample
poverty	Total annual income of each person's family expressed as a percentage of their family's poverty threshold

Note. ACS data were obtained via IPUMS USA (Ruggles et al., 2025), restricting to 4-year-olds. We used variables above to generate estimates of percent of 4-year-olds in a given state/ year that met various definitions of preschool enrollment (see methodological section of Supplement above). Note that the specific items listed here were obtained from the ACS 2024 survey. There may have been slight deviations in wording in other years of the survey.

Table S3. Steps of State-by-Year Variable Generation using Individual-level ACS Data

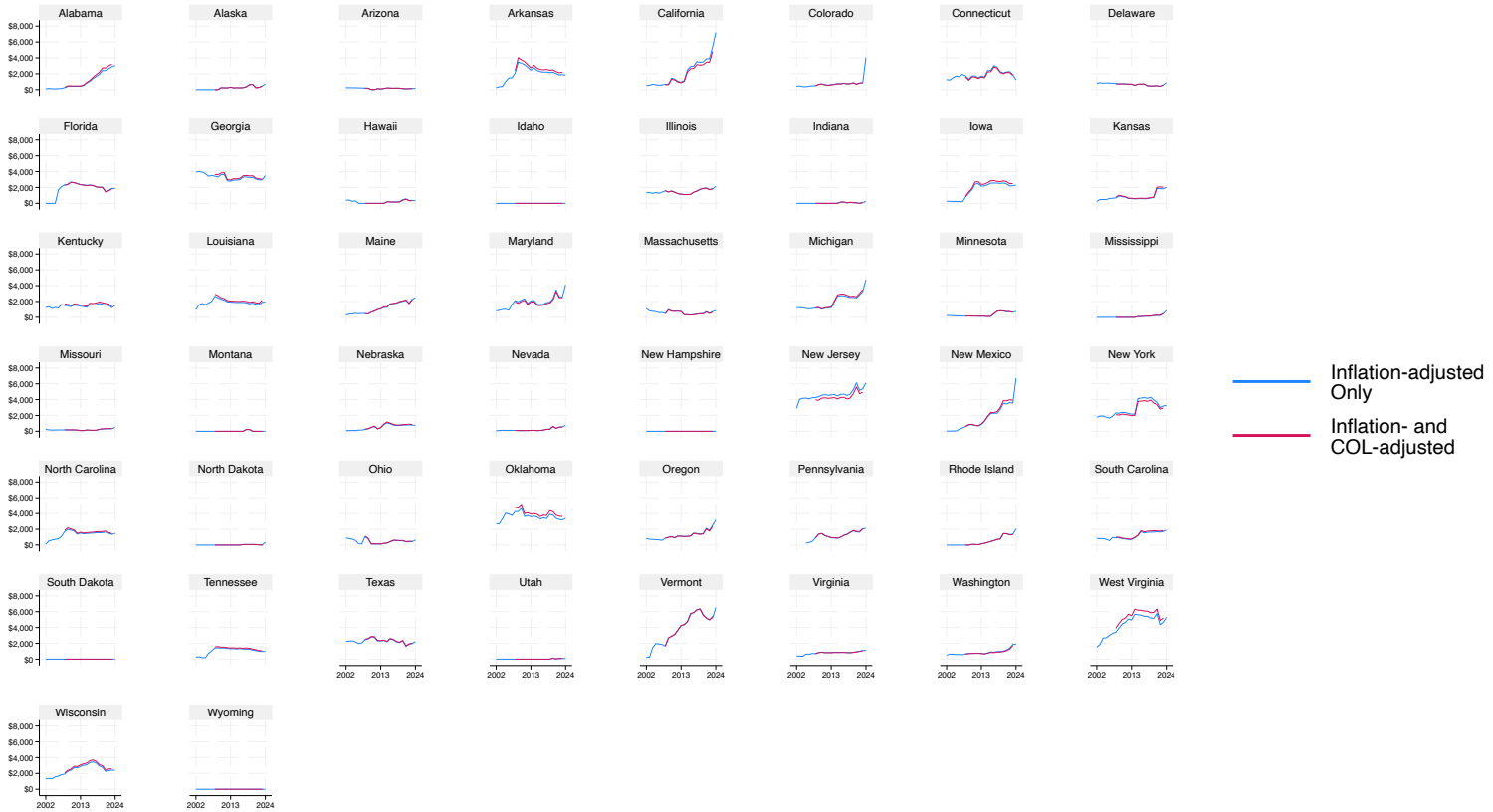
Generated Variable	Steps
Any preschool enrollment among all 4-year-olds	created flag for children who met three criteria: *schltype*==2|3 ("public school" or "private school")) & *gradeattd*==10 ("nursery school"); multiplied each flag by *perwt* person weights, then summed all within a state-year; divided by estimate of all 4yos per state-year
Any preschool enrollment among low-income 4-year-olds	created flag for children who met three criteria: *schltype*==2|3 ("public school" or "private school") & *gradeattd*==10 ("nursery school") & *poverty*<=185; multiplied each flag by *perwt* person weights, then summed all within a state-year; divided by estimate of 4yos per state-year with *poverty*<=185

Figure S2. State Pre-K Spending per 4-year-old in the State over Time, by Individual State



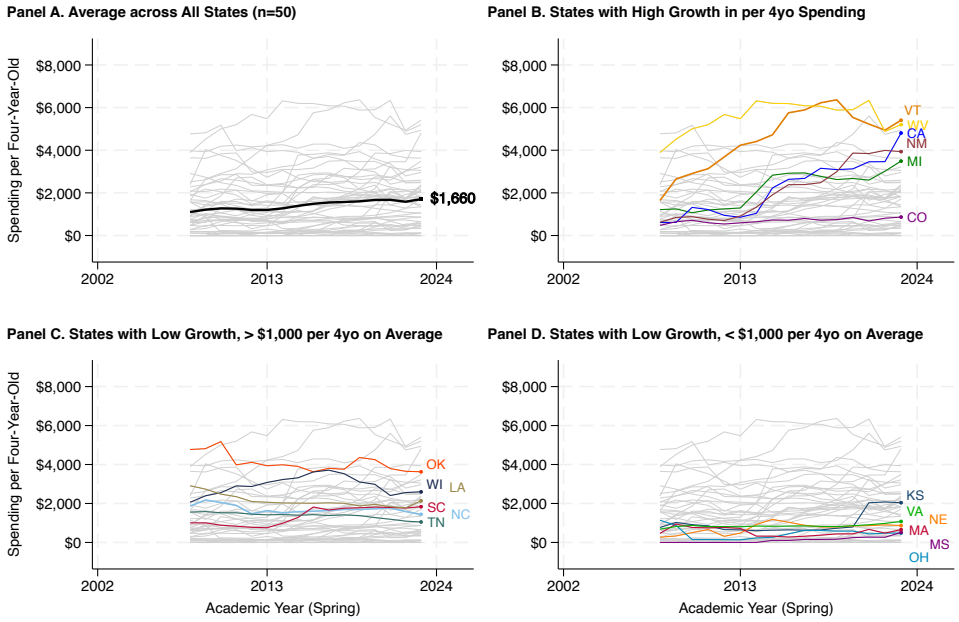
Note. The individual state plots above were used to code each state in "spending trajectories" of state pre-K spending per 4-year-olds. Panels A through D indicate which spending category each state was coded into. Spending levels for each year have been adjusted to 2024 dollars. "State Pre-K Spending" variable was calculated by dividing total state pre-K spending by total number of 4-year-olds in the state population for a given year, then multiplying by the proportion of children enrolled who were 4 years old in that academic year. See description of coding process above.

Figure S3. State Pre-K Spending Trajectories with Cost of Living- Adjusted Spending (2008-2023)



Note. The above figure compares our variable of state pre-K spending per four-year old in the state (scaled to 2024 dollars), with the same figure also adjusted for states'/ years' cost of living (COL), acquired via the Bureau of Economics Analysis. Note that COL adjusters were only available for years 2008-2023.

Figure S4. State Pre-K Spending per 4-year-old in the State, Adjusted for Cost of Living (2008-2023)



Note. Spending was adjusted to 2024 dollars. "Spending per 4-year-old" was calculated by dividing total state pre-K spending by total number of 4-year-olds in the state population for a given year, then multiplying by the proportion of children enrolled who were 4 years old. We then multiplied these values by cost-of-living adjusters acquired via the Bureau of Economic Analysis. Note that COL adjusters were only available for years 2008-2023. In all panels, gray lines represent states (n = 50 in each). Panel A shows the unweighted average per 4-year-old spending across all states ($1,660 in 2023). Panels B through D show exemplar states of each "spending trajectory" category (coded by the research team), highlighting states with the largest ranges in per 4-year-old spending (within each group) across all years.

Table S4. Descriptives of Selected State Characteristics by State Pre-K "Spending Trajectories"

	High Growth (*n* = 18)		**Low Growth / >$1K Avg. (*n* = 11)**		**Low Growth / <$1K Avg. (*n* = 13)**		**No Program (*n* = 8)**		**All States (*n* = 50)**	
Variable	Mean	SD btw.	Mean	SD btw.	Mean	SD btw.	Mean	SD btw.	Mean	SD btw.
Population (millions)	8.20	9.32	8.29	6.57	4.43	3.25	1.93	1.99	6.24	6.95
3- and 4-yo pop. (%)	2.40	0.20	2.59	0.19	2.59	0.17	2.66	0.40	2.53	0.25
Black child pop. (10% units)	1.10	0.96	1.93	1.09	1.27	1.14	0.27	0.35	1.19	1.08
Hispanic child pop. (10% units)	1.86	1.56	1.54	1.20	1.55	1.19	0.97	0.52	1.57	1.27
GSP per capita ($)	68,447	12,650	67,780	11,375	73,881	14,513	68,590	11,205	69,736	12,558
State minimum wage ($)	10.70	1.23	9.32	1.31	10.09	1.29	8.98	0.77	9.96	1.35
Unemployment rt. (%)	5.71	0.87	5.80	0.56	5.40	1.09	4.29	0.81	5.42	0.99
Employment rt. among women (%)	74.84	4.70	73.30	4.20	76.53	4.32	78.32	3.21	75.50	4.49
Child poverty rt. (%)	25.23	6.10	28.81	5.59	23.68	6.28	21.86	4.91	25.08	6.14
Average welfare recipient rt. (%)	8.86	1.69	8.81	1.38	7.66	1.48	5.78	1.11	8.05	1.83
NSLP participation rt. (%)	35.77	6.34	40.51	4.94	37.38	6.60	38.67	6.57	37.69	6.26
SBP participation rt. (%)	15.01	5.05	17.72	5.09	13.73	3.62	11.06	2.40	14.64	4.76
Governor is Democrat (1=yes)	0.56	0.27	0.43	0.28	0.40	0.29	0.23	0.29	0.44	0.29

Avg. fraction Democrats in state leg.	0.56	0.12	0.45	0.09	0.51	0.19	0.29	0.10	0.48	0.16
Total women in office (%)	27.55	7.40	21.41	6.51	26.89	6.36	23.07	5.37	25.31	6.96
Head Start enrl. per 4yo (10% units)	1.03	0.39	0.98	0.26	1.03	0.69	1.16	0.52	1.04	0.47
CCDF enrl. per 4yo (10% units)	0.56	0.16	0.52	0.11	0.53	0.17	0.52	0.13	0.53	0.15
Medicaid spending per capita ($10,000 units)	1.01	0.25	0.89	0.15	1.08	0.28	1.14	0.21	1.02	0.24
Adjusted cohort graduation rt. (10 % units)	8.30	0.49	8.47	0.44	8.29	0.45	8.46	0.30	8.36	0.44
K-12 PPE ($10,000 units)	1.74	0.49	1.47	0.37	1.61	0.37	1.45	0.40	1.60	0.42
K-12 enrollee pop. (%)	15.29	1.00	16.28	1.29	15.84	1.39	16.40	2.22	15.83	1.44
Infant mortality (%)	5.97	1.22	6.99	0.96	6.40	1.31	5.93	0.93	6.30	1.19
Youth in juvenile detention (%)	0.20	0.06	0.17	0.05	0.20	0.07	0.25	0.11	0.20	0.07
Observations	18		11		13		8		50	

Note. The above table shows descriptive statistics of relevant state characteristics by four groups of state pre-K spending trajectories (High Growth; Low Growth/ Lower Spending; Low Growth/ Higher Spending; and No Program). Years included range from academic years 2001-02 to 2023-24. State characteristics are from the first calendar year in a given academic year (e.g. calendar year 2001 for academic year 2001-02), and were averaged across the entire panel for each state. "SD btw." reflects the standard deviation of state-level means, capturing variation across states averaged over time. avg.=average, K=thousand, yo=year-old, pop.=population, GSP=Gross State Product, min.=minimum, rt.=rate, NSLP=National School Lunch Program, SBP=School Breakfast Program, leg.=legislature, enrl.=enrollment, CCDF=Child Care and Development Fund, PPE=Per Pupil Expenditure.

Table S5. Associations of State Baseline Characteristics and Membership in State Pre-K "Spending Trajectories"

	High Growth	Low Growth, >$1K Avg.	Low Growth, <$1K Avg.	No Program
Population (millions)	0.01	-0.00	-0.00	-0.00
	(0.02)	(0.01)	(0.02)	(0.01)
3- and 4-year-old pop. (pp)	-0.64	-0.78	0.66	0.76
	(0.89)	(0.60)	(0.67)	(0.50)
Black child pop. (pp)	0.02	0.00	-0.02	-0.00
	(0.02)	(0.01)	(0.02)	(0.01)
Hispanic child pop. (pp)	0.01	0.00	-0.01	-0.00
	(0.02)	(0.01)	(0.01)	(0.01)
GSP per capita ($1,000 units)	-0.03*	0.01	0.02	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
State min. wage ($)	0.03	0.03	-0.13	0.07
	(0.06)	(0.04)	(0.07)	(0.04)
Unemployment rt. (pp)	-0.04	0.15	0.03	-0.14
	(0.12)	(0.13)	(0.12)	(0.07)
Employment rt. among women (pp)	-0.02	-0.00	0.03	-0.01
	(0.03)	(0.03)	(0.03)	(0.02)
Child poverty rt. (pp)	-0.03	0.03*	-0.02	0.02
	(0.02)	(0.01)	(0.02)	(0.01)
Average welfare recipient rt. (pp)	0.08	-0.05	0.05	-0.08
	(0.07)	(0.07)	(0.08)	(0.05)
NSLP participation (pp)	-0.01	0.03	-0.02	-0.00
	(0.03)	(0.02)	(0.02)	(0.02)
SBP participation (pp)	-0.04	0.01	0.05	-0.02
	(0.06)	(0.06)	(0.04)	(0.03)
Governor is Democrat (1=yes)	0.08	0.17	-0.01	0.10
	(0.22)	(0.17)	(0.15)	(0.14)
Avg. fraction democrats in state leg.	0.42	-0.02	0.33	-0.73*
	(0.71)	(0.61)	(0.62)	(0.35)
Total women in office (10 pp units)	0.18	-0.16	0.04	-0.05
	(0.16)	(0.15)	(0.15)	(0.09)
Head Start enr. per 4yo (10 pp units)	-0.00	-0.33	0.24	0.09
	(0.19)	(0.17)	(0.26)	(0.12)
CCDF participation per 4yo (10 pp units)	0.47	-0.65	-0.23	0.41
	(0.67)	(0.43)	(0.63)	(0.45)
Medicaid sp. per capita ($10,000 units)	-0.17	-0.50	0.31	0.36

	(0.51)	(0.42)	(0.54)	(0.27)
Adjusted cohort grad. rt. (10 pp units)	0.04	0.05	-0.07	-0.02
	(0.23)	(0.21)	(0.24)	(0.14)
K-12 PPE	0.05	0.03	-0.07	-0.01
	(0.04)	(0.03)	(0.04)	(0.02)
K-12 enrollee pop. (pp)	-0.01	0.16	-0.12	-0.04
	(0.10)	(0.09)	(0.08)	(0.07)
Infant mortality (pp)	-0.06	0.03	0.07	-0.04
	(0.11)	(0.08)	(0.11)	(0.07)
Youth in juvenile detention (per 1,000)	0.19	-0.24*	-0.00	0.04
	(0.12)	(0.10)	(0.15)	(0.09)
Constant	3.94	-2.75	-0.65	0.45
	(4.35)	(3.50)	(4.35)	(2.40)
Observations	50	50	50	50
R-squared	0.50	0.56	0.41	0.69

* $p < .05$, ** $p < .01$, *** $p < .001$

Results are shown for four linear probability analyses predicting states' membership in state pre-K spending trajectories, using baseline (2002) state characteristics. Thus, each column represents results from a single regression model in which the variable listed in the top heading (e.g., high growth binary indicator) was regressed on all of the variables listed in the first column. Robust Standard Errors are in parentheses. yo=year-old, pop.=population, pp= percentage points, GSP=Gross State Product, min.=minimum, rt.=rate, avg.=average, K=thousand, NSLP=National School Lunch Program, SBP=School Breakfast Program, enrl.=enrollment, leg.=legislature, CCDF=Child Care and Development Fund, sp.=spending, grad.=graduation, PPE=Per Pupil Expenditure.

Table S6. Associations between Time-Varying State Characteristics and State Pre-K Spending per 4-year-old

	Spending per 4yo ($1,000s)
Population (millions)	0.02
	(0.10)
3- and 4-year-old pop. (pp)	0.13
	(0.43)
Black child pop. (pp)	-0.10**
	(0.05)
Hispanic child pop. (pp)	-0.07
	(0.05)
GSP per capita ($1,000 units)	0.00
	(0.01)
State min. wage ($)	0.04
	(0.03)
Unemployment rate (pp)	-0.04
	(0.03)
Employment rate among women (pp)	-0.02
	(0.02)
Child poverty rt. (pp)	-0.01
	(0.01)
Average welfare recipient rt. (pp)	0.17**
	(0.07)
NSLP participation (pp)	-0.02*
	(0.01)
SBP participation (pp)	0.05***
	(0.01)
Gov. is Democrat (1=yes)	0.06
	(0.08)
Average fraction democrats in state leg.	0.30
	(0.52)
Percent total women in office (10 pp units)	0.07
	(0.10)
Head Start enrollment per 4yo (pp)	0.00
	(0.05)
CCDF participation per 4yo (pp)	0.00
	(0.03)
Log-transformed K-12 PPE (10% units)	0.21**
	(0.09)
K-12 enrollee pop. (pp)	0.01
	(0.11)
Infant mortality (pp)	-0.16

	(0.50)
Constant	0.72
	(3.23)
State-year observations	927
Within R-squared	0.39

* $p < .05$, ** $p < .01$, *** $p < .001$

Note. Estimates come from linear panel regressions regressing state pre-K spending per 4-year-old on all state characteristic variables, with state and year fixed effects. *N*= 927 state-year observations across 50 states. Robust Standard Errors are in parentheses. State-year observations with missing data on any of the above variables were excluded. yo=year-old, pop.=population, GSP=Gross State Product, min.=minimum, rt.=rate, avg.=average, NSLP=National School Lunch Program, SBP=School Breakfast Program, gov.=governor, leg.=legislature, CCDF=Child Care and Development Fund, PPE=Per Pupil Expenditure.

Table S7. State Pre-K Enrollment Rate and Spending per Enrolled 4-year-old (β (*SE*))

	State pre-K spending per enrolled 4-year-old ($)
State pre-K enrollment rate (pp)	19.01
	(17.44)
Constant	5075.12***
	(395.46)
State-year observations	1147

* $p < .05$, ** $p < .01$, *** $p < .001$

Note. Robust standard errors are shown in parentheses. Standard errors clustered at the state level. Model includes state and year fixed effects. Both variables are expressed in raw units. Spending levels for each year have been adjusted to 2024 dollars "Spending per Enrolled 4-year-old" was calculated by dividing total state pre-K spending by total number of enrollees. The NIEER "State pre-K Enrollment rate" was calculated by dividing the total number of 4-year-olds enrolled in state pre-K by the population of 4-year-olds in the state, then multiplying by 100 to express this figure as a percent. Note that three observations were excluded from the analysis because of missing pre-K spending data (Pennsylvania years 2002-2004). pp=percentage points.

Table S8. State pre-K Enrollment Rate and Spending per Enrolled 4-year-old, Excluding 2021 (β (*SE*))

	State pre-K spending per enrolled 4-year-old ($)
State pre-K enrollment rate (pp)	21.13
	(17.12)
Constant	5053.34***
	(383.97)
State-year observations	1097

* $p < .05$, ** $p < .01$, *** $p < .001$

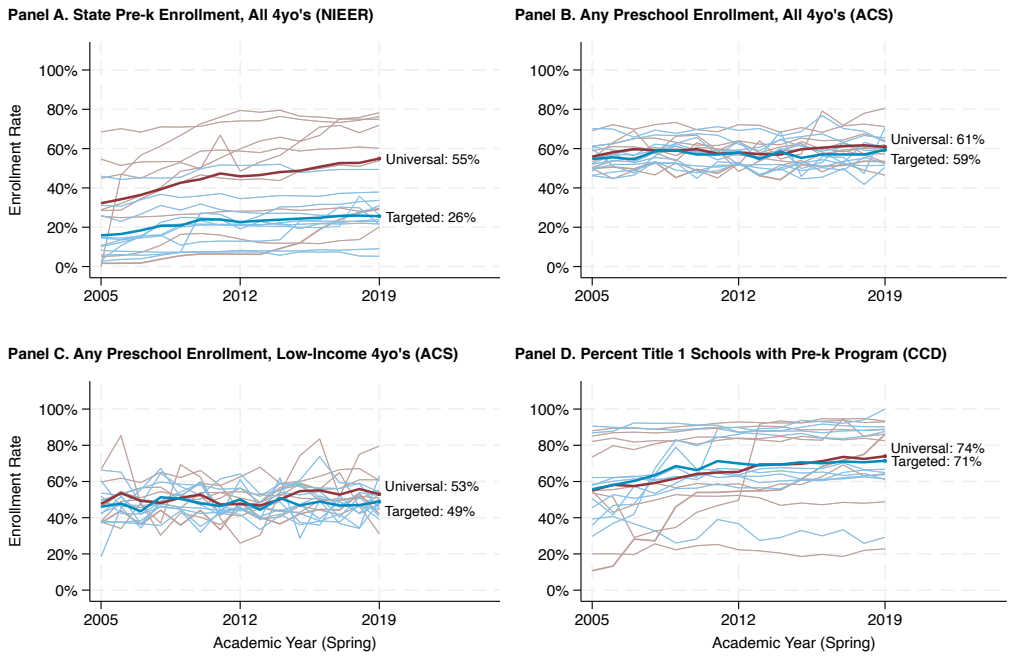
Note. In response to anomalous enrollment patterns in academic year 2020-21 due to the pandemic, we ran our regression model excluding data from that year. Robust standard errors are given in parentheses. Standard errors clustered at the state level. Model includes state and year fixed effects. Both variables are expressed in raw units. Spending was adjusted to 2024 dollars. "Spending per Enrolled 4-year-old" was calculated by dividing total state pre-K spending by total number of enrollees. The NIEER "State pre-K enrollment rate" was calculated by dividing the total number of 4-year-olds enrolled by the population of 4-year-olds in the state, then multiplying by 100 to express this figure as a percent. Note that in addition to the 2021 data, three observations were excluded from the analysis because of missing pre-K spending data (Pennsylvania years 2002-2004). pp=percentage points.

Table S9. States Reclassified under Alternative Definition of "Universal" for Sensitivity Checks

Sample included in the 2005-2019 Figures (Figure S5)	
State	**Reported Eligibility Criteria**
Maine	Child disability or developmental delay; Low parent education; History of abuse, neglect, or family violence; Homelessness or unstable housing; Home language other than English; Parental substance abuse; Risk child will not be ready for kindergarten; Teen parent; Low birth weight or other child health risk; Child history of foster care; Parent on active military duty (2015-2020)
Missouri	Programs are funded through a competitive process and receive extra points for serving children with special needs or from low-income families. (2005-2006)
New Mexico	Other state-specified risk factors (2007-2012)
West Virginia	Child disability or developmental delay (2009-2012)
Sample included in the 2024 single-year tests	
State	**Reported Eligibility Criteria**
Maine	Locally determined income eligibility requirements
Mississippi	Child disability or developmental delay; Homelessness or unstable housing; Home language other than English; Risk that child will not be ready for kindergarten; Child history of foster care; Parent on active military duty
Washington	Child disability or developmental delay; Low parent education; History of abuse, neglect, or family violence; Homelessness or unstable housing; Home language other than English; Parental substance abuse; Risk that child will not be ready for kindergarten; Teen parent; Low birth weight or other child health risk; Child history of foster care; Parent on active military duty

Note. The above table lists states that were reclassified for our sensitivity checks on enrollment by program model. The first section, "2005-2019 Figures," maps onto Figure 4 from the main text. In the sensitivity check we excluded four states previously designated as Universal because they no longer met the designation under this more stringent definition throughout the entire period from 2005-2019 (above we include the years the reported eligibility criteria apply to in parentheses). The second section, "sample included in the 2024 single-year tests," maps onto the means reported in the text of the manuscript. For the sensitivity check on these analyses, states that no longer met the designation under this more stringent definition of Universal were reclassified as Targeted states for that year/ analysis.

Figure S5. Preschool enrollment rates of all v. low-income 4-year-olds by income eligibility, using an alternative definition of "Universal" (n = 19 states)



Note. Graphs above plot individual- and school-level access for different preschool types, data sources (NIEER, ACS, CCD), and populations (all 4-year-olds, those from low-income families). "Low-income" ≤ 185% of the Federal Poverty Level. In contrast to our figures depicting these distinctions in the main text, here we applied a more stringent definition of consistently Universal, excluding states that reported any indication of limiting or prioritizing enrollment based on risk factors (see details above). Included states had consistently Universal (n = 9) or Targeted income eligibility (n = 10) from 2005-2019 (see Supplement for details). Thick lines represent unweighted averages across states in each group, and label averages in 2019. NIEER=National Institute of Early Education Research, ACS=American Community Survey, CCD=Common Core of Data.

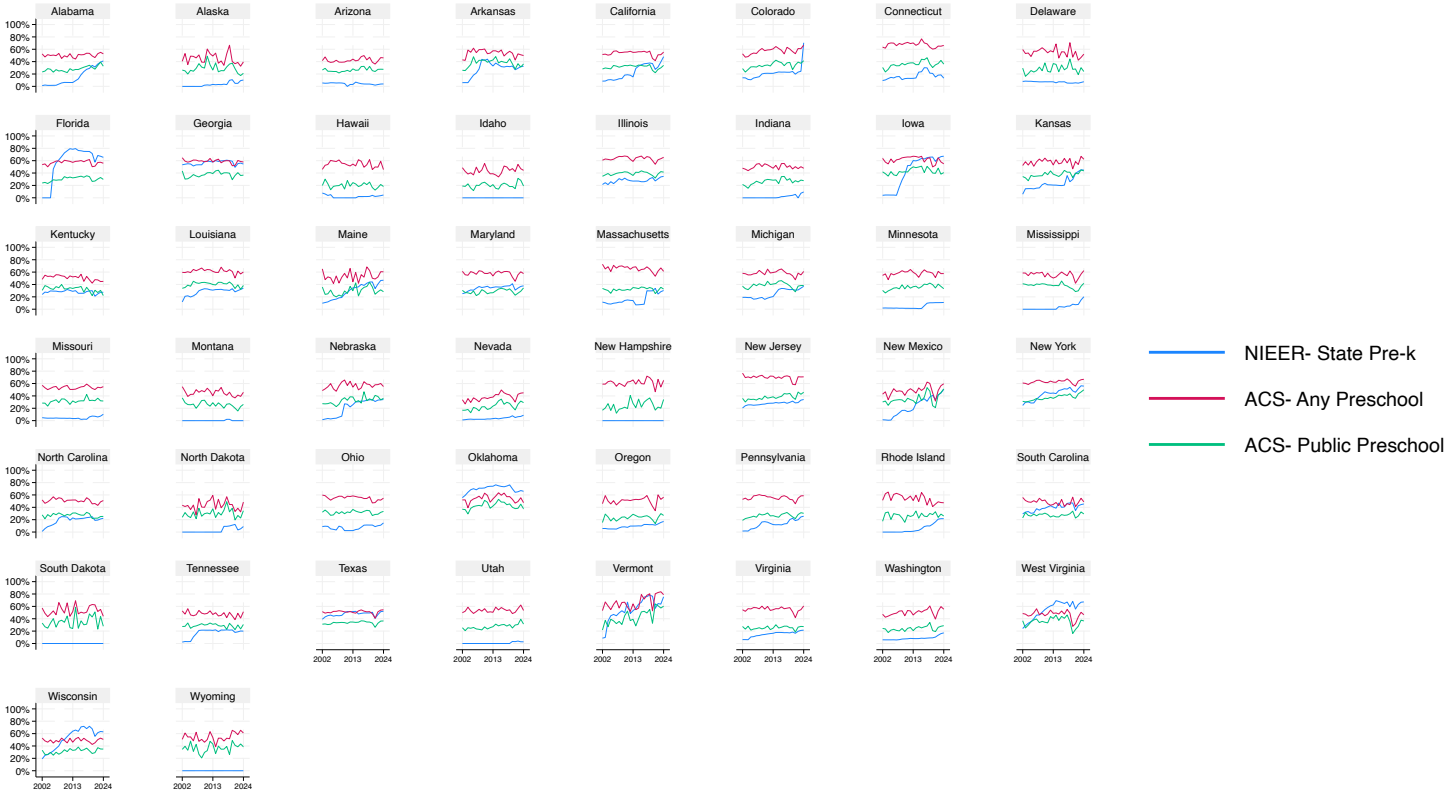
Table S10. Associations between NAEP Achievement Scores and State Pre-K Spending per 4-year-old the Following Year (β (*SE*))

	State pre-K spending per 4-year-old ($)
Grade 4 Math	-828.10
	(842.07)
Grade 4 Reading	-364.64
	(749.94)
Grade 8 Math	652.78
	(617.40)
Grade 8 Reading	557.34
	(811.27)
Constant	766.67***
	(111.02)
State-year observations	499

* $p < .05$, ** $p < .01$, *** $p < .001$

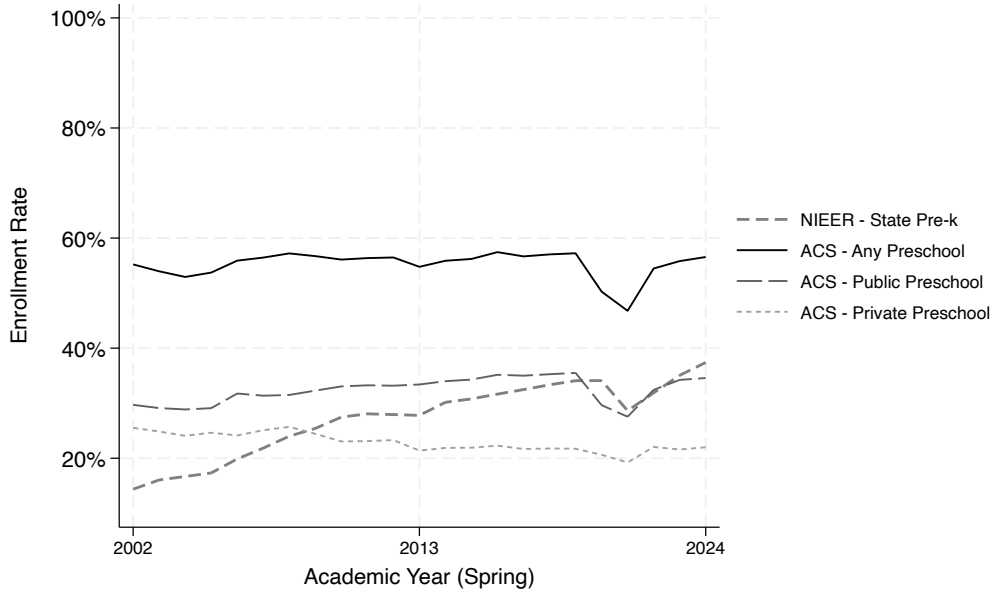
Note. Estimates come from linear panel regressions regressing state pre-K spending per 4-year-old on state-level average achievement scores as reported by the National Assessment of Educational Progress (NAEP) from the previous year, with state fixed effects. Robust standard errors are given in parentheses. Standard errors clustered at the state level. Spending per four-year old is expressed in raw units. Spending levels for each year have been adjusted to 2024 dollars. Note that this analysis was limited to years in which NAEP scores are reported.

Figure S6. Individual State Enrollment Rates by Data Source



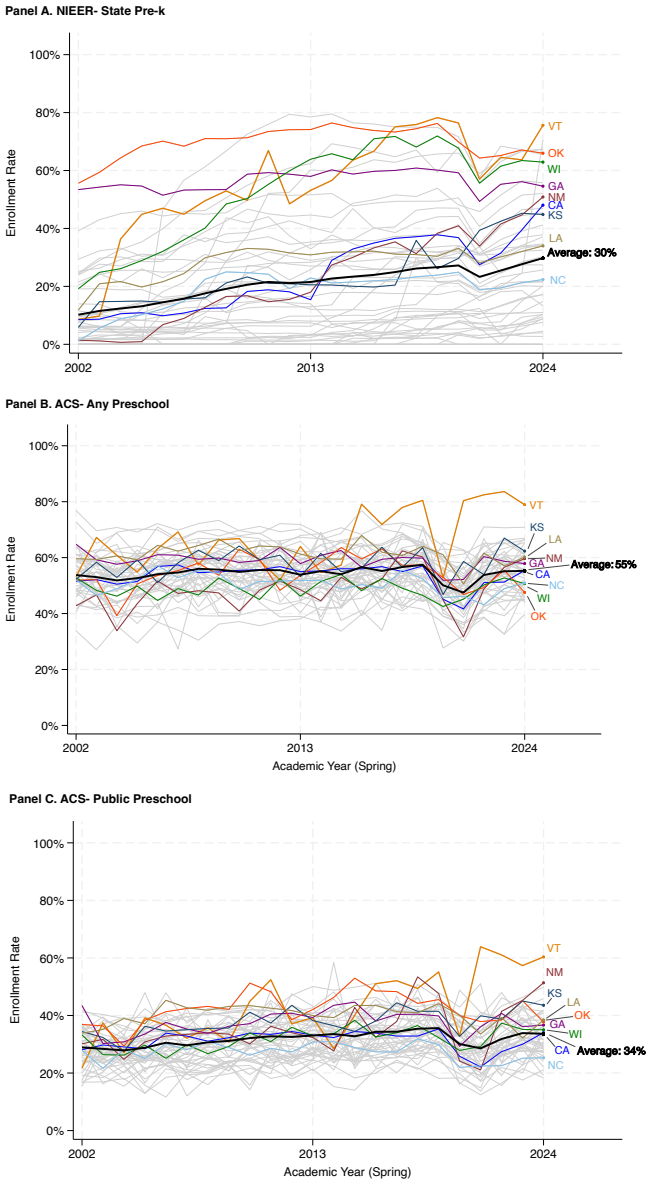
Note. Here we compare measures of preschool enrollment across our two primary sources, NIEER and the ACS. NIEER's "State Pre-K Enrollment Rate" represents -year-old enrollment in state pre-K programs, whereas the ACS makes no distinction between state and federal (i.e., Head Start) or local programs. Thus, ACS "Public Preschool Enrollment Rate" includes any publicly funded program, and "Any Preschool Enrollment Rate" any public or private program. Because it may be challenging for parents to report on the funding structure of their child's preschool program we focus our analyses on the ACS "Any Preschool Enrollment Rate", but include the "Public Preschool Enrollment Rate" here as a point of comparison. NIEER=National Institute of Early Education Research, ACS=American Community Survey.

Figure S7. National Enrollment Rate by Data Source



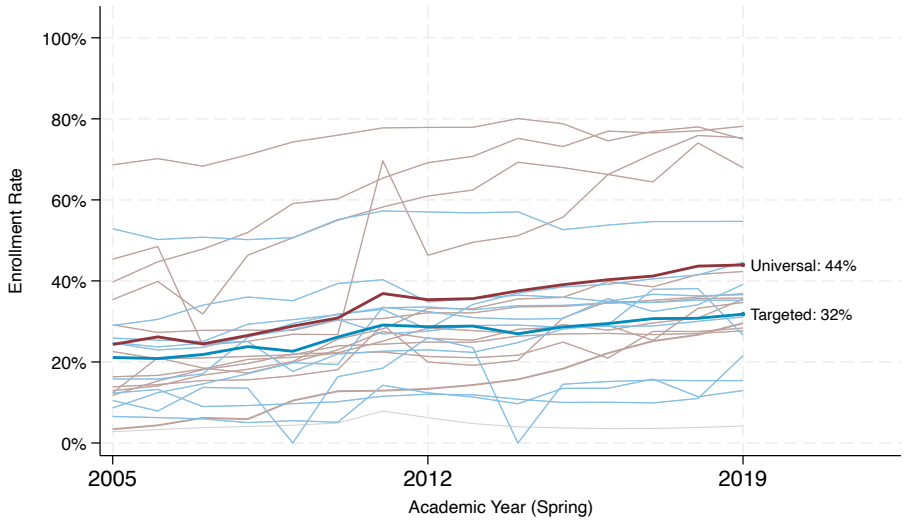
Note. The above figure compares national (i.e., weighted across states) enrollment rates among 4-year-olds across three measures: (1) NIEER state pre-K enrollment rate, which reflects 4-year-old enrollment in state-funded pre-Kindergarten as reported annually by state administrators; (2) ACS public pre-K enrollment rate, which includes 4-year-olds enrolled in public nursery school programs (including state pre-K, Head Start, and other locally funded public programs); and (3) ACS any preschool enrollment rate, which additionally includes private preschool and Head Start enrollment. NIEER=National Institute of Early Education Research, ACS=American Community Survey.

Figure S8. All State 4-year-old Enrollment Rates by Data Source



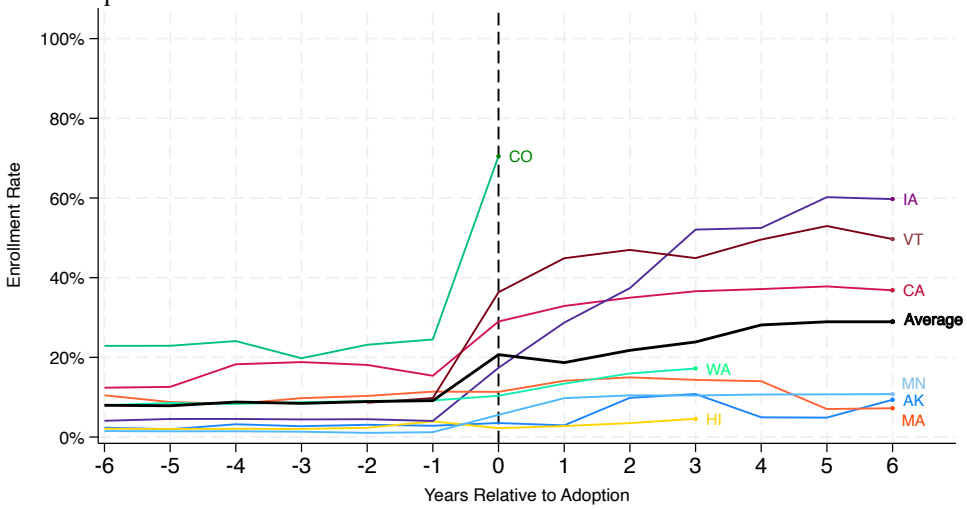
Note. The above graphs plot enrollment rate trajectories among 4-year-olds for all states, highlighting exemplar states, across three measures: Panel A shows NIEER state pre-K, Panel B shows ACS any preschool, and Panel C shows ACS public preschool enrollment rate. Thin gray lines represent individual state trajectories; the thick black line represents the unweighted average across all states. NIEER enrollment reflects participation in state-funded pre-Kindergarten only, while ACS public preschool additionally includes Head Start and other publicly funded preschool programs, and ACS any preschool further includes private preschool enrollment. NIEER=National Institute of Early Education Research, ACS=American Community Survey.

Figure S9. Enrollment Rate in School-Based Pre-K Among All 4-year-olds by Income Eligibility (n = 23 states)



Note. This graph plots 4-year-old enrollment rate in school-based pre-K among our subset of 23 states (see methods above) using the Common Core of Data (CCD). Each thin line represents a state. To generate these estimates, we aggregated school/grade/year level data (i.e., enrollment in pre-K in a given school/year) to the state-year level, divided by population of 4-year-olds in a given state-year, and multiplied by proportion of 4-year-old enrollees. Included states were consistently Universal (n = 13) or Targeted income eligibility (n = 10) from 2005-2020 (see above for details). Note that Oregon was excluded due to missing data. Thick lines represent unweighted averages across states in each group, and label averages in 2019.

Figure S10. Change in 4-year-old State Pre-K Enrollment Rate Among States that Switched to No Income Requirements



Note. The above figure includes states that switched at some point throughout the panel from having only programs with income requirements, to at least one program with no income requirements (n = 9), in the six years preceding the time of adoption to the six years following it. States were coded as Universal when they had any state-funded pre-K program that had no income eligibility requirements, and Targeted when the only program(s) they offered in those years did have some level of income requirement. Enrollment rate of all 4-year-olds was calculated by dividing the total number of 4-year-olds enrolled (reported by administrators via NIEER annual reports) by the population of 4-year-olds in the state. Each state (as well as the unweighted average across states) is centered on its year of adoption of Universal (at 0), so that changes in enrollment rate from -1 to 0 represent changes that took place the year it adopted a universal program. Note that because Colorado's switch took place in 2024, there is no enrollment data in the post-adoption period.

Supplement References

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