Western MA Per Pupil Spending Report

With selected districts for comparison

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Executive Summary

How to use this report: The report is organized from broad regional patterns down to district-level details. As a descriptive report, it makes no forecasts and offers no recommendations. Since most of this report is descriptive statistical reference material, one way to use it would be as a companion to discussions that depend on meaningful cost comparisons. You could read straight through to build understanding from high-level trends to selected district details. Or you could use this quick-start guide to answer two specific questions: How do my school district finances compare to Western MA baselines? How does the growth rate of my district finances compare?

Quick-start guide:

1. Review the **Cohort comparison: Western MA enrollment cohorts and districts of interest** on the next page.

2. Refer to **Section 1: Western MA traditional district trends—Scatterplot of enrollment vs. per-pupil expenditure with quartile boundaries (2024)** to see how all districts are grouped into cohorts using 2024 enrollment numbers.

3. Locate your district in **Section 3: Specific districts compared to cohorts** to see details of district expense categories, enrollment, Chapter 70 aid, and required net school spending (NSS) and actual NSS compared to cohort benchmarks.

Are our public school district costs growing out of control, or are they growing at rates that we should expect?

Per-pupil expenditure (PPE) is a cloudy lens for education finance analysis. It reduces complex school systems — shaped by community wealth, student needs, facility age, governance choices, and historical commitments — into a single number that tempts expedient comparisons. It could work better if it factored per pupil costs by program participation, but that data isn't available. Examined on its own, PPE obscures more than it reveals about education quality, district efficiency, or resource adequacy.

However flawed, PPE can't be wished away. It's embedded in state reporting and media coverage. It's the metric officials and taxpayers use to make sense of school spending. PPE means little to families choosing schools for their children, but for elected officials, ignoring it looks evasive. The question isn't whether to use PPE, but how to use it responsibly, with appropriate context to prevent misleading conclusions while surfacing patterns that support decisions.

These decisions — by school committees, administrators, and municipal appropriating bodies — affect both student outcomes and the fiscal effort taxpayers bear to provide adequate education. Careful scrutiny of the metrics informing our decisions is essential.

This report takes that approach. It breaks down PPE into comparable expense categories, state aid, and local contributions for Western Massachusetts districts organized into enrollment-based cohorts. These cohorts group districts by scale to compare what costs have been, not to establish norms or suggest what costs should be. The purpose is not to rank districts like racehorses, but to provide a reference manual for productive deliberation about education budgets in the context of local and regional economy and policy environments.

What's driving high costs? The question tempts speculation. Declining enrollment? Fixed costs dependent on a primarily residential tax base? Inequitable loss of state aid? Increased local property values and incomes alongside population decline? The school choice movement? Baumol's cost disease — where education wages rise predictably to compete with productivity-driven wage growth in other industries, despite natural limits to productivity gains in the classroom?

In February 2025, an Amherst Town Councilor questioned why regional school spending was "increasing faster than the town's revenue, especially given the significant long-term reduction in the number of students we teach."[1] If our towns operate under the expectation that school costs should track municipal revenue and scale with enrollment, it's unclear where these expectations originate. They don't appear in historical budget data from most Western Massachusetts districts. The expectation that education costs will or shall rise at the same rate as inflation has been contested for a very long time[2].

The assumption may conflate two independently-determined budget lines. Education is a labor-intensive service where 80-85% of costs are personnel — salaries and benefits including health insurance and pension contributions. Growth of wages,

insurance, and retirement is determined by sector and regional markets, not local tax revenue trajectories. "Roughly 85% of the budget each year is to cover the cost of salaries and benefits."[3] National data shows school districts spend close to 90% of their instructional budgets on staff and benefits — more than double the 35-40% typical in other public and private organizations.[4] Special education services are legally mandated regardless of enrollment, with costs driven by student needs rather than total enrollment change and because Massachusetts special education formulas do not reimburse districts in proportion to need or local fiscal effort. Health insurance premiums have risen dramatically faster than general inflation. Fixed facility costs, transportation requirements, and retirement obligations don't decline proportionally with enrollment. Charter schools compound the problem: districts lose state aid while paying charter tuition, shrinking budgets for remaining students.

These are all likely causes, but they overlook the key question: Are our district costs growing out of control, or are they growing at predictable rates? When we analyze spending on a per-pupil basis — putting enrollment in the denominator — for the selected districts in this report **(Amherst-Pelham, Amherst, Leverett, Pelham, Shutesbury)**, the data suggest that school budgets in these districts have grown at typical rates. Given typical budget growth, a significant driver of today's high PPE is yesterday's high PPE. In 2009, these districts had high PPE compared to their Western Massachusetts peers. During 2009-2024, they saw PPE growth rates equal to — if not lower than — their peers. Their PPE remains high today because it was already high 15 years ago, likely much earlier. With average growth applied to an above-average baseline, the gap will persist.

This doesn't explain why these districts had high PPE 15 years ago, nor does it prescribe solutions — unless preparing for predictable growth rates counts as a solution. It does highlight something worth repeating: recent cost trajectories of our schools have not been exceptional. The challenge these districts face is sustaining historically high spending levels due to the democratic and administrative choices made by previous generations, not runaway growth. Those earlier decisions were no doubt made in the best interests of students and the community. But if local and regional economy and policy environments have not kept up with those best interests, and if today's school expenses are a problem as a result, then an economy and policy problem that was decades in the making will likely take more than a few years to resolve — requiring patient, open-minded public deliberation and candid data analysis rather than assertive quick fixes that won't solve the underlying issues but will jeopardize student outcomes.

References:

1. Amherst Indy, "Letter: Correcting Councilor Ryan on the Regional School Budget"
https://www.amherstindy.org/2025/02/07/letter-correcting-councilor-ryan-on-the-regional-school-budget/

2. Where's the Money Gone? Changes in the Level and Composition of Education Spending (1995) and Inflation and the Measurement of School Spending (1996)

https://www.epi.org/publication/books_wheremoneygone/ https://nces.ed.gov/pubs97/97535/97535jx1.asp

3. 4 Towns Meeting & Special Meeting of the Regional School Committee, "School Budgeting Basics and FAQ", November 2021
https://go.boarddocs.com/ma/arps/Board.nsf/goto?open&id=C8SLXU58B56B

4. American Association of School Administrators, "School Budgets 101"
https://www.aasa.org/docs/default-source/resources/reports/school-budgets-101.pdf

All data in this report comes from the Massachusetts Department of Elementary and Secondary Education (DESE). See Appendix A for detailed source information.

DESE's comparison tools (DART, RADAR) use multi-factor matching weighted toward demographics for performance analysis. This report takes a complementary approach focused on enrollment for cost pattern analysis, while acknowledging that districts within cohorts still differ substantially in wealth, demographics, geography, and governance.

Opportunities for improving this report:

1) **Comprehensive revenue analysis.** This report presents costs in per-pupil terms, which places enrollment in the denominator—controlling for enrollment fluctuations when analyzing expense growth over time. The report touches on revenue through Chapter 70 aid and net school spending requirements, but primarily to show state aid versus actual local contribution rather than analyzing revenue source composition. Comprehensive analysis of revenue trends and strategies for revenue development would strengthen this work. For related analysis, see the draft report by the Amherst-Pelham Regional School Committee's Fiscal Sustainability Subcommittee at the September 23, 2025 meeting:
https://go.boarddocs.com/ma/arps/Board.nsf/goto?open&id;=DLM3SC083619

2) **Per capita analysis.** Calculating costs per municipal resident alongside costs per student would provide a more complete picture. When enrollment declines while population and total school spending remain relatively stable, per-pupil costs rise faster than per-capita costs, signaling fixed costs that resist adjustment to smaller student populations. When population declines while enrollment and spending remain relatively stable, per-capita costs rise faster than per-pupil costs, signaling increased fiscal burden on a shrinking tax base. Either pattern reveals rising fiscal effort required to sustain adequate education, which is information that is essential for municipal planning.

3) **Rural Schools Commission.** Synthesis between this report and the July 2022 report by the Rural Schools Commission, along with ongoing advocacy by the MASC Rural Schools Committee, would provide valuable context: https://www.repblais.org/ruralschools https://www.ruralschoolsma.org/

Combining these perspectives would help communities discuss education costs in the broader context of rural fiscal capacity, demographic trends, and the structural challenges facing many districts.

4) **Including pre-2009 data**. DESE's reporting format changed significantly in 2009, making earlier data incompatible with this analysis framework without substantial reformatting. Extending the analysis back through the 2008 recession and the immediate post-Proposition 2½ period would strengthen historical baseline analysis and reveal the origin story of above-baseline spending evident in 2009.

Draft Status: As of October 24, 2025, this report is under review and has not been presented to any committee. Questions and comments should be directed to the author, Tim Shores (Leverett and Amherst-Pelham Regional School Committee member) at shorest@arps.org.

Report Navigation:

Executive Summary (continued)

Total PPE comparison: Western MA enrollment cohorts and selected districts

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp	Above baseline
	Baseline
CAGR = (End/Start)^(1/years) – 1	Below baseline

Table 1

Cohort/District	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Western MA (all, excl. Springfield)	$12,234	+4.0%	+4.6%	+6.0%	$22,065
Western MA Tiny (0-200 FTE)	$14,738	+4.2%	+4.4%	+6.0%	$27,504
Western MA Small (201-800 FTE)	$12,523	+4.6%	+5.1%	+6.7%	$24,622
Western MA Medium (801-1600 FTE)	$13,032	+4.1%	+4.7%	+6.1%	$23,785
Western MA Large (1601-10K FTE)	$11,775	+3.9%	+4.5%	+5.9%	$20,841
Outliers (Springfield)	$14,608	+4.1%	+5.7%	+9.4%	$26,615

Table 2

Cohort/District	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Western MA Medium (801-1600 FTE)	$13,032	+4.1%	+4.7%	+6.1%	$23,785
Amherst-Pelham Regional	$16,211	+3.8%	+3.8%	+4.8%	$28,233
Amherst	$16,029	+4.6%	+4.7%	+5.7%	$31,267

Table 3

Cohort/District	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Western MA Tiny (0-200 FTE)	$14,738	+4.2%	+4.4%	+6.0%	$27,504
Leverett	$15,156	+2.5%	+0.5%	+2.0%	$21,910
Pelham	$14,733	+3.0%	+3.3%	+5.9%	$23,040
Shutesbury	$14,011	+4.4%	+5.3%	+5.0%	$26,908

Table 1 compares PPE and cost growth of Western MA school district cohorts with the benchmark of all Western MA districts. **Tables 2 and 3** benchmark districts against their cohort averages.

Cohorts are organized by enrollment size. Grouping districts by enrollment size enables more meaningful cost comparisons—districts of similar size face similar challenges with administration, staffing, facilities, and program requirements. Detailed information about cohorts follow in **sections 1 and 2**. Detailed comparisons of individual districts to cohorts follow in **sections 2 and 3**.

Enrollment size is just one factor. Districts in the same cohort can differ significantly in wealth, demographics, geography, facility age, and governance, all of which shape costs and outcomes. Per-pupil expenditure (PPE) figures can obscure these differences, which is why this report examines PPE through detailed revenue and expenditure subcategories over time, not just top-line comparisons. Therefore, this breakdown alone won't tell the complete story of education funding and outcomes in each district and cannot support useful claims about which districts are 'efficient' or 'wasteful.' That requires local knowledge and deliberation of community priorities, student needs, and historical context. Instead, this breakdown can reveal patterns and anomalies that support and invite well-grounded investigation of education costs across a large region.

Executive Summary (continued)

Per-pupil expenditure and recent growth overview: 2019 PPE (lighter) to 2024 PPE (darker segment)

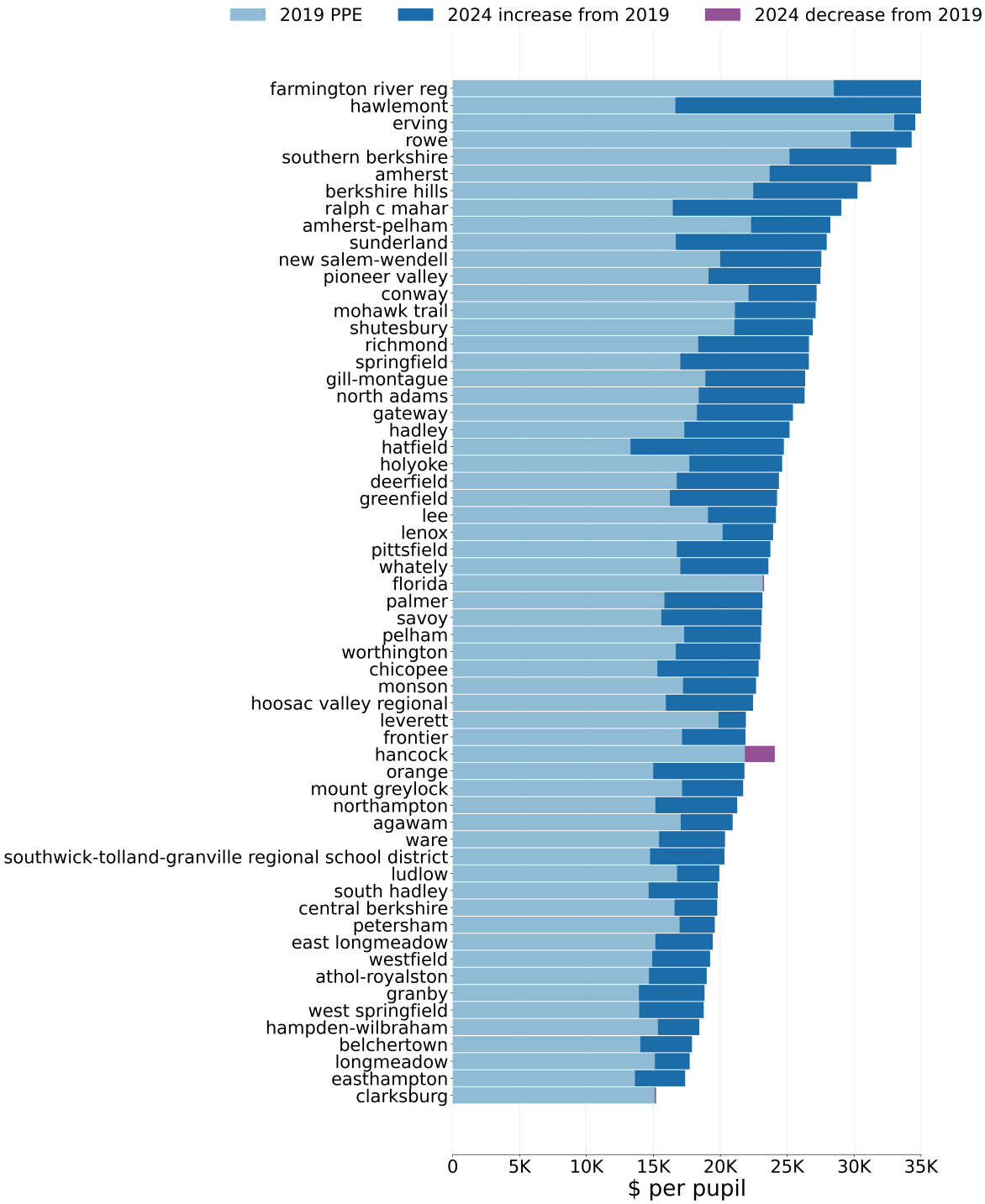

Figure 1

Each bar represents a district's per-pupil expenditures (PPE) in 2024, with growth from 2019 shown by a darker color. Districts are sorted by 2024 spending. While the spread is visible, this alone is nearly meaningless: we don't know if the difference between $15K and $30K per student reflects education quality, cost-of-living adjustments, special education demand, economies of scale, administrative decisions, ballot box decisions, or legacy cost structures.

Note: The following districts are omitted from this analysis: Chesterfield-Goshen (missing expenditure data), Hampshire (missing expenditure data), Southampton (missing expenditure data), Warwick (no enrollment data), Westhampton (missing expenditure data), Williamsburg (missing expenditure data).

Executive Summary (continued)

Statistical Associations

Statistical Analysis: Associations Between Enrollment Cohorts, Enrollment Growth, and Per-Pupil Expenditures

This section examines statistical associations between district characteristics (enrollment cohort, enrollment growth rate) and per-pupil expenditure patterns (2024 amounts and 2009-2024 growth rates). These analyses help identify whether certain district characteristics are systematically associated with spending levels or growth rates.

Summary of Findings:

Analysis of Western Massachusetts traditional districts (2009-2024) reveals weak to moderate statistical associations between enrollment characteristics and per-pupil expenditures. Enrollment cohort (district size) shows a modest association with 2024 spending levels but minimal association with spending growth rates. Enrollment growth rate shows weak associations with both current spending and spending growth. Combined models explain only a small portion of variation in district spending patterns, confirming that enrollment characteristics alone cannot predict per-pupil expenditures.

Distribution of PPE and Growth Rates by Enrollment Cohort

Two five-number summaries show how districts within each cohort compare: current spending levels (2024 PPE) and long-term growth trajectories (2009-2024 CAGR). Together, these show whether cohorts differ more in their spending baselines or their growth rates.

2024 PPE by Cohort

This summary shows the spread of 2024 PPE within each cohort. The box plot visualizes the middle 50% of districts (box from Q1 to Q3), with the median marked inside. Whiskers extend to the minimum and maximum values. Wide boxes indicate greater spending variation within a cohort; narrow boxes suggest more similar spending patterns.

Cohort	n	Min	Q1	Median	Q3	Max	Distribution
Tiny (0-200 FTE)	17	$19,591	$23,040	$26,631	$27,953	$44,178	
Small (201-800 FTE)	13	$15,078	$21,881	$24,382	$25,430	$33,162	
Medium (801-1600 FTE)	15	$17,371	$21,026	$23,154	$26,734	$31,267	
Large (1601-10K FTE)	14	$17,710	$18,815	$19,627	$21,180	$24,619	
Outliers (Springfield >10K FTE)	1	$26,615	$26,615	$26,615	$26,615	$26,615	

2009-2024 PPE CAGR by Cohort

This summary shows the distribution of 15-year compound annual growth rates within each cohort. It reveals whether districts in a cohort grew at similar rates (narrow box) or experienced widely different trajectories (wide box). Comparing medians across cohorts shows which size categories saw faster or slower PPE growth.

Cohort	n	Min	Q1	Median	Q3	Max	Distribution
Tiny (0-200 FTE)	16	2.1%	3.0%	4.5%	5.0%	7.2%	
Small (201-800 FTE)	13	1.3%	4.0%	4.6%	5.4%	6.8%	
Medium (801-1600 FTE)	15	2.2%	3.6%	4.0%	4.6%	5.5%	
Large (1601-10K FTE)	14	2.9%	3.4%	3.9%	4.3%	4.6%	
Outliers (Springfield >10K FTE)	1	4.1%	4.1%	4.1%	4.1%	4.1%	

A cohort with high 2024 PPE but typical CAGR suggests historically high spending maintained over time. A cohort with typical 2024 PPE but high CAGR indicates recent acceleration. Comparing these patterns helps distinguish baseline differences from growth trajectory differences.

Detailed Statistical Results:

1. Enrollment Cohort and 2024 Per-Pupil Expenditure ANOVA test examining whether different enrollment cohorts (Tiny, Small, Medium, Large) have systematically different per-pupil expenditures in 2024. Results show a statistically significant but modest association ($F = 3.85$, $p = 0.014$, $\eta^2 = 0.216$), indicating that enrollment cohort explains approximately 22% of the variation in 2024 PPE. Effect size interpretation: small to medium effect, suggesting cohort membership has some predictive value but substantial variation exists within cohorts.

2. Enrollment Cohort and Per-Pupil Expenditure Growth (2009-2024) ANOVA test examining whether different enrollment cohorts experienced different growth rates in per-pupil expenditures from 2009 to 2024. Results show no significant association ($F = 0.61$, $p = 0.611$, $\eta^2 = 0.036$), indicating that enrollment cohort does not predict PPE growth patterns. Effect size interpretation: negligible effect.

3. Enrollment Growth Rate and 2024 Per-Pupil Expenditure Linear regression examining whether districts with higher enrollment growth rates (2009-2024) have higher 2024 per-pupil expenditures. Results show a weak positive association ($r = 0.226$, $R^2 = 0.051$, $p = 0.160$), which is not statistically significant at $\alpha = 0.05$. The model explains only 5.1% of PPE variation. Slope interpretation: for every 1% increase in enrollment growth, 2024 PPE increases by approximately $33.50, but this relationship is not reliable given the weak correlation.

4. Enrollment Growth Rate and Per-Pupil Expenditure Growth (2009-2024) Linear regression examining whether districts with higher enrollment growth experienced higher PPE growth rates. Results show a weak negative association ($r = -0.175$, $R^2 = 0.031$, $p = 0.283$), which is not statistically significant. The model explains only 3.1% of PPE growth variation. Slope interpretation: enrollment growth does not predict PPE growth patterns.

5. Combined Model: Cohort + Enrollment Growth $\rightarrow$ 2024 Per-Pupil Expenditure ANCOVA combining both predictors (enrollment cohort and enrollment growth rate) to predict 2024 PPE. Results show modest explanatory power ($R^2 = 0.232$, Adjusted $R^2 = 0.155$, $F = 3.02$, $p = 0.023$). The combined model is statistically significant but explains only 23% of PPE variation, with the adjusted R^2 suggesting that adding enrollment growth provides minimal improvement over cohort alone.

6. Combined Model: Cohort + Enrollment Growth $\rightarrow$ PPE Growth (2009-2024) ANCOVA combining both predictors to predict PPE growth rates from 2009-2024. Results show no significant explanatory power ($R^2 = 0.069$, Adjusted $R^2 = -0.027$, $F = 0.74$, $p = 0.569$). The negative adjusted R^2 indicates that the model performs worse than simply using the mean PPE growth rate. Effect size interpretation: enrollment characteristics do not predict spending growth patterns.

Interpretation Notes: These analyses examine statistical associations, not causal relationships. Significant associations indicate that certain district characteristics tend to occur together with certain spending patterns, but do not prove that one causes the other. Many other factors (wealth, demographics, facility age, governance, etc.) also influence per-pupil expenditures.

Section 1 — Western MA traditional public school district trends

Section 1 examines per-pupil expenditure (PPE) trends across all Western Massachusetts traditional school districts, organized by enrollment-based cohorts.

This section provides a regional overview before diving into cohort-specific details (Section 2) and individual district comparisons (Section 3).

Contents:

Year-over-Year (YoY) growth rates: Shows the rate of PPE change from 2009-2024 for Amherst-Pelham, Amherst, Leverett, Pelham, Shutesbury, and their cohorts.

5-year and 15-year CAGR by district and cohort: Shows how compound annual growth rate (CAGR) smooths out the volatility of YoY rates of change, making it easier to understand and compare change in PPE over time.

Distribution of 2024 enrollment and proposed cohort grouping: Shows a histogram of Western MA districts by enrollment with cohorts determined by statistics visualized by the histogram.

Scatterplot analysis: Shows the relationship between district enrollment and PPE for 2024, with a table of cohort members.

All districts are grouped into enrollment cohorts based on 2024 in-district FTE using IQR (Interquartile Range) analysis. This grouping enables meaningful peer comparisons while acknowledging that enrollment size is just one factor influencing costs. Districts in the same cohort can differ significantly in wealth, demographics, geography, facility age, and governance—all of which shape costs and outcomes.

Report Navigation:

Section 1 — Western MA traditional public school district trends

Year-over-Year (YoY) growth rates by district and cohort

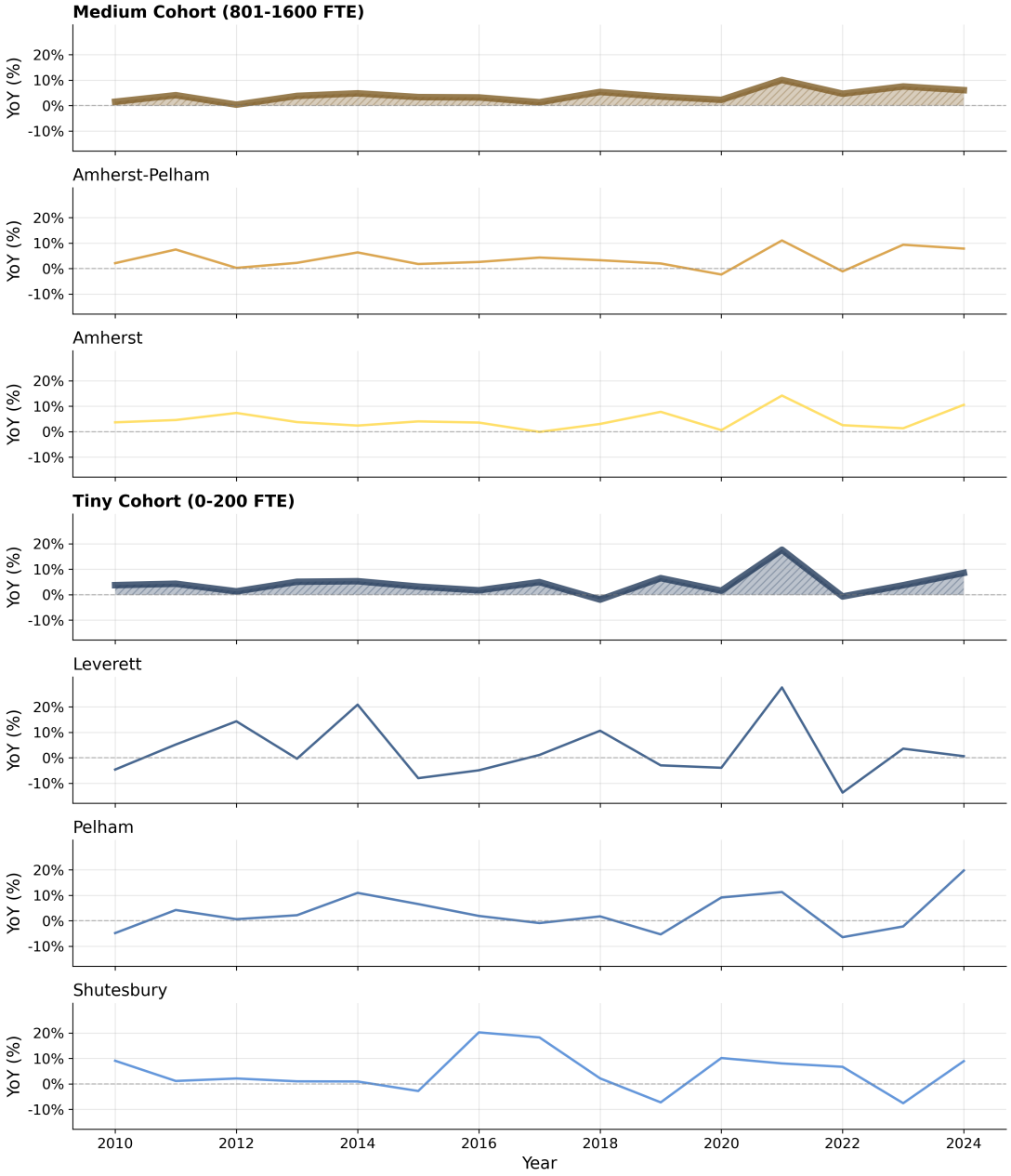

Figure 2

These plots show year-over-year (YoY) growth rates in per-pupil expenditure (PPE) for districts of interest and their enrollment cohorts. The districts are organized into enrollment cohorts based on student population size. The thicker lines represent cohort aggregates, while thinner lines show individual districts within each cohort. The determination of these cohorts is explained in detail in Appendix A. While patterns can be observed in these plots, it is difficult to discern a clear, consistent signal across all districts and cohorts over the 2009-2024 period.

Section 1 — Western MA traditional public school district trends

5-year and 15-year CAGR by district and cohort

Unlike the peaks and valleys of YoY rates, compound annual growth rates (CAGR) show smoother long-term trends that enable comparison between districts. The visualization below uses color to group districts by enrollment cohorts (blues for Tiny, golds for Medium), with diagonal white lines marking cohort baselines. By comparing three 5-year periods (2009-2014, 2014-2019, 2019-2024), we can observe how growth rates have shifted over time. The second chart shows overall 15-year CAGR from 2009 to 2024.

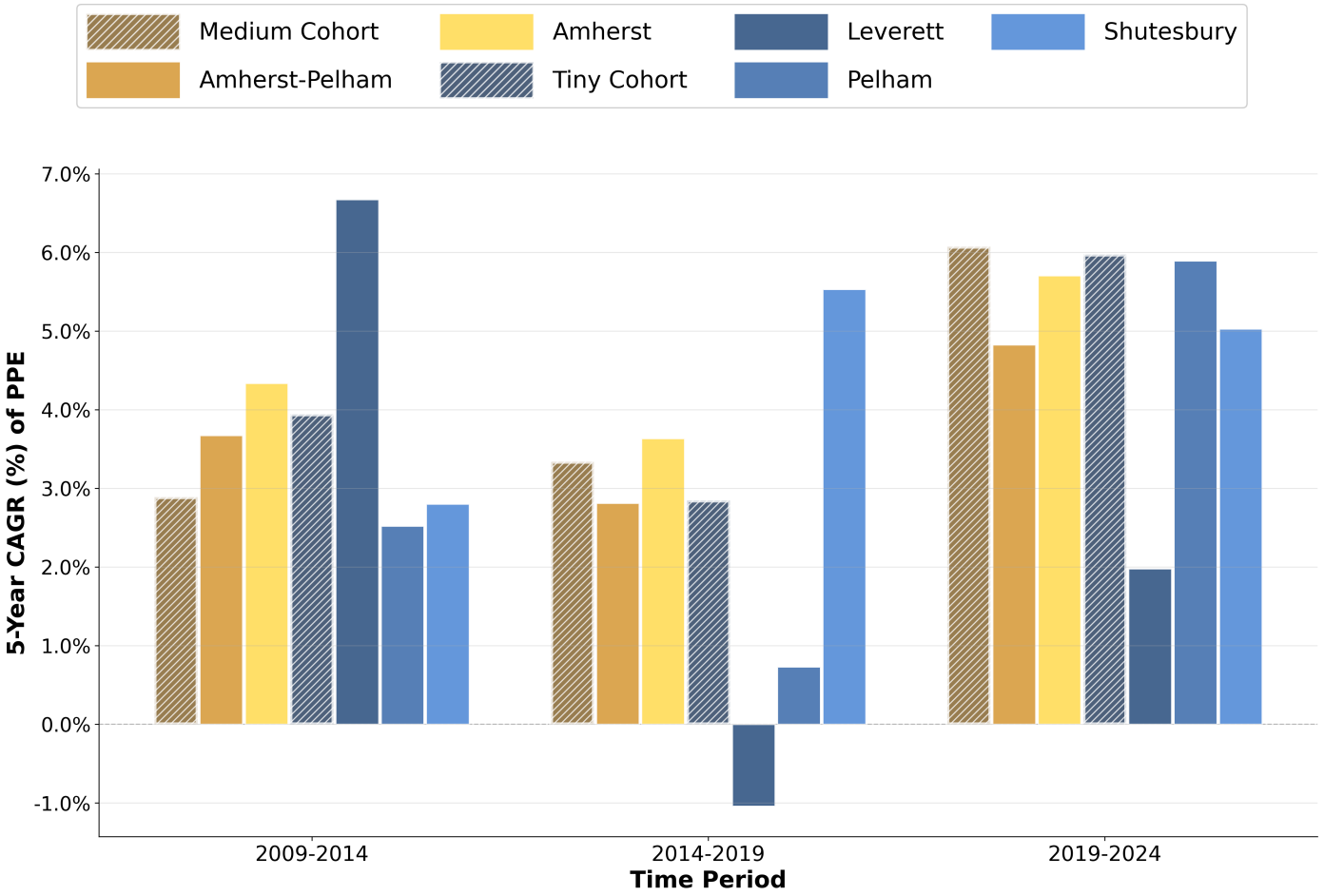

Figure 3

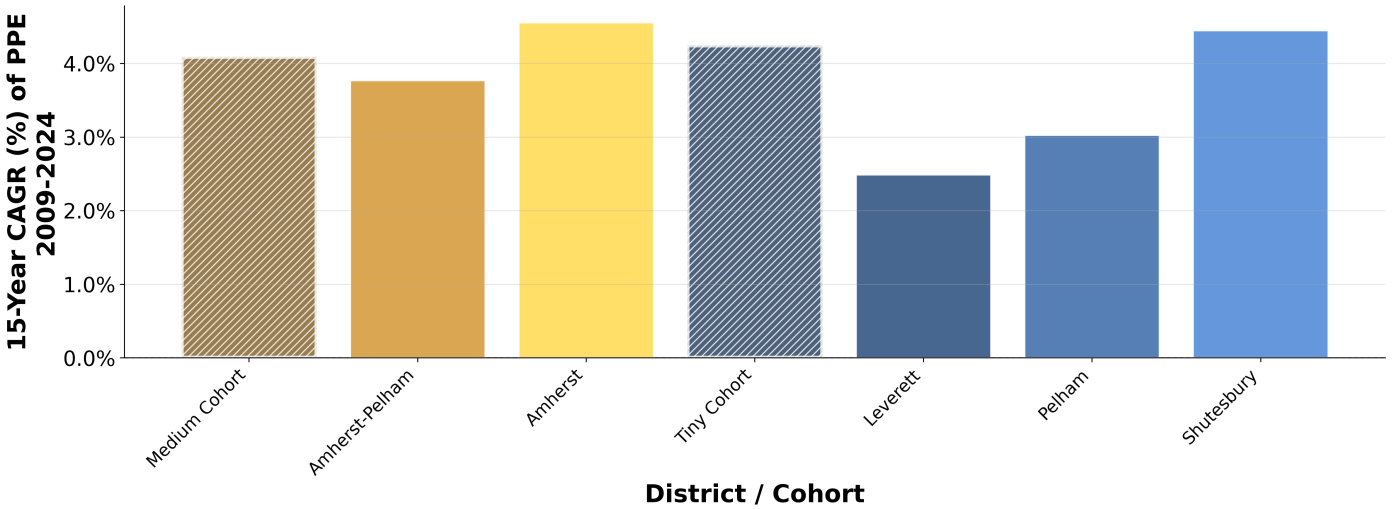

Figure 4

Section 1 — Western MA traditional public school district trends

Distribution of 2024 enrollment and proposed cohort grouping

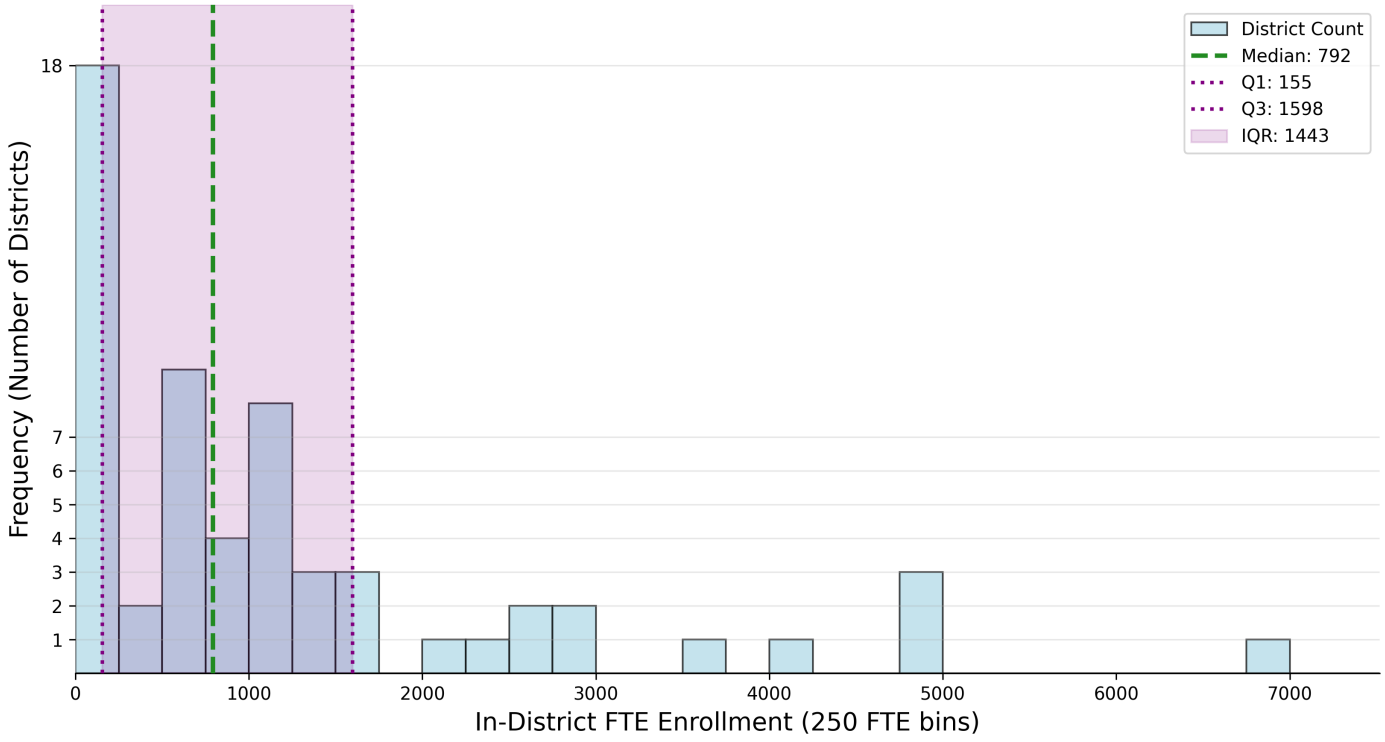

Figure 5

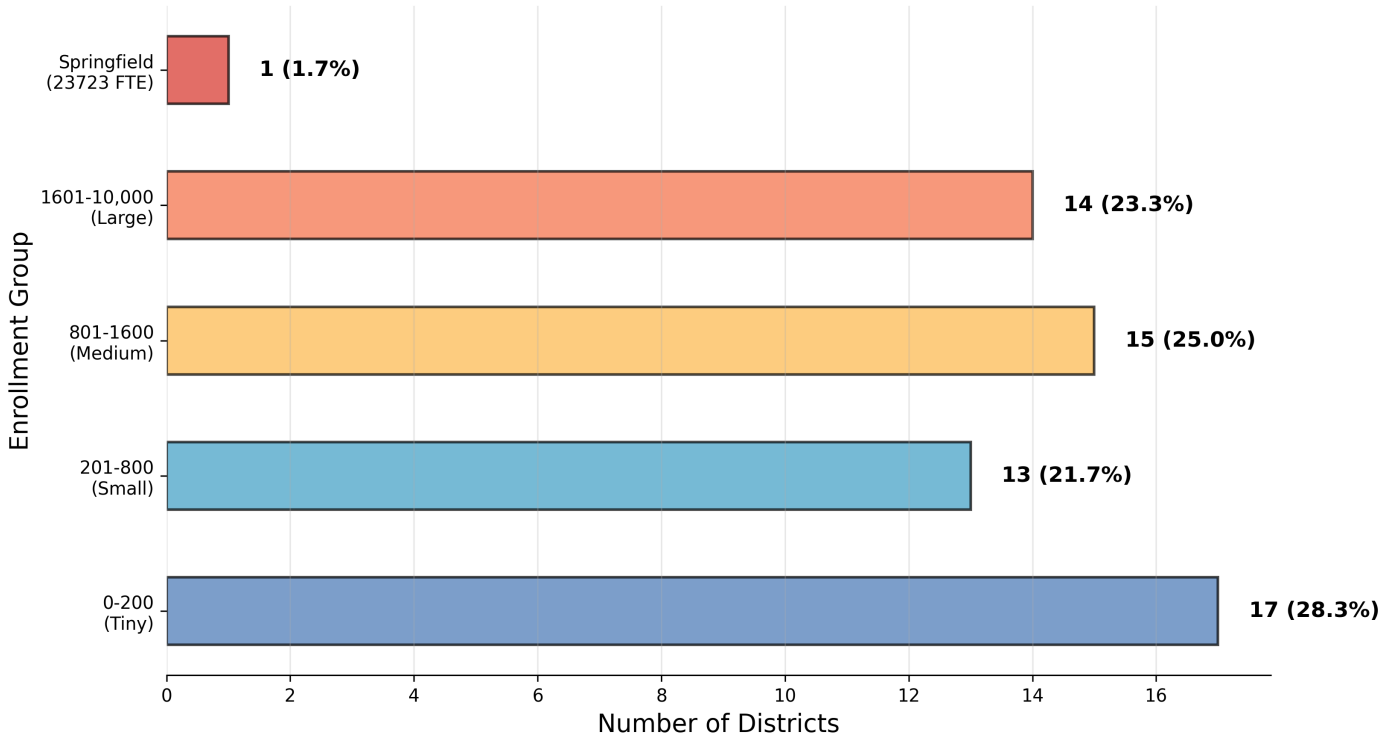

Figure 6

Bucketing districts into enrollment cohorts requires deciding where to draw boundaries between size categories. To avoid picking arbitrary cutoffs, the approach here uses the spread of district enrollments. The histogram (top) shows a **right-skewed distribution of districts by 2024 enrollment** using 250 in-district enrollment FTE bins, with a long right tail and sparse districts at higher enrollments. Based on interquartile range (IQR) description of the spread of data, districts are grouped into four enrollment-based cohorts (bottom): Tiny (0-200 FTE), Small (201-800 FTE), Medium (801-1600 FTE), and Large (1601-10,000 FTE). Springfield (>10,000 FTE) is excluded as a statistical outlier. As noted in the Executive Summary, these cohorts group districts by scale to compare what costs have been, not to establish norms or suggest what costs should be.

The next page shows each district's **enrollment and PPE**, both visually in a scatterplot and in a reference table by cohort.

Section 1 — Western MA traditional public school district trends

Scatterplot of enrollment vs. per-pupil expenditure with quartile boundaries (2024)

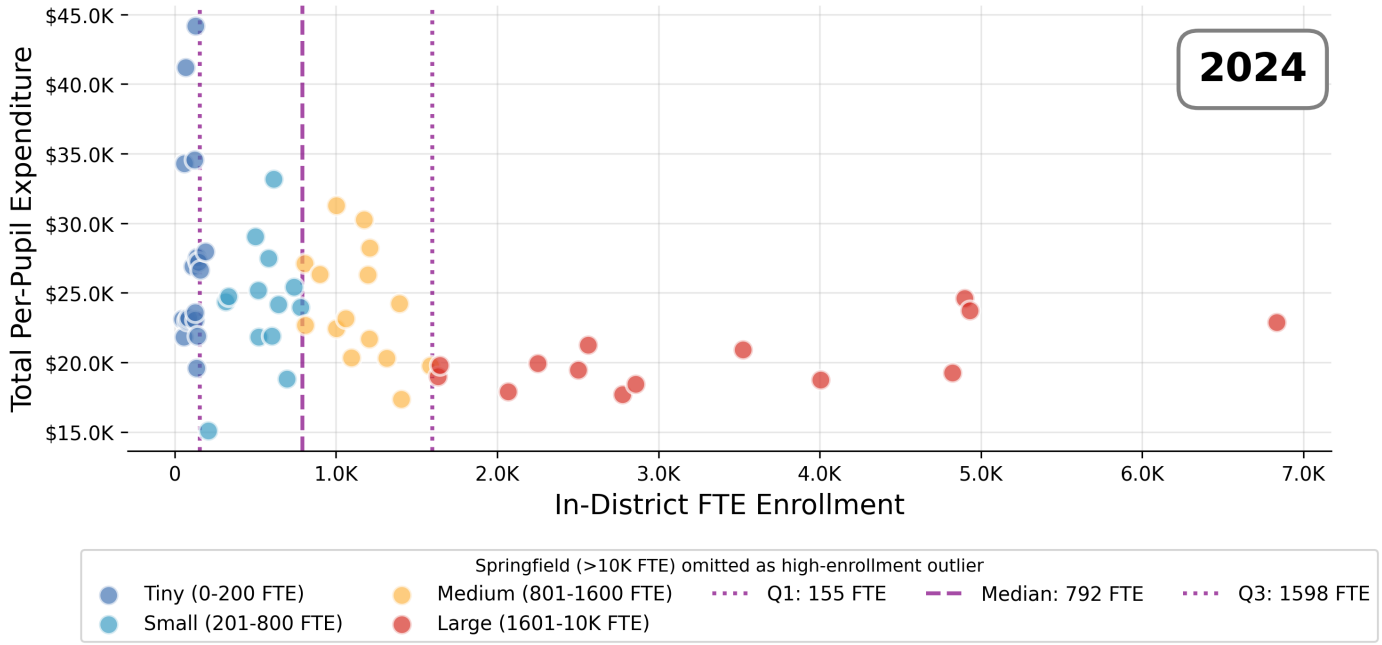

Figure 7

Table 4

District	2024 FTE	2024 PPE ▼
Hawlemont	108	$41,189
Rowe	86	$34,297
New Salem-Wendell	148	$27,553
Conway	155	$27,200
Shutesbury	129	$26,908
Whately	136	$23,593
Florida	94	$23,175
Savoy	62	$23,099
Pelham	136	$23,040
Worthington	140	$22,985
Leverett	145	$21,910
Hancock	106	$21,836
Petersham	141	$19,591
Farmington River Reg	254	$44,178
Erving	208	$34,566
Southern Berkshire	758	$33,162
Ralph C Mahar	622	$29,040
Sunderland	209	$27,953
Pioneer Valley	664	$27,490
Richmond	210	$26,631
Hadley	624	$25,173
Hatfield	412	$24,752
Deerfield	355	$24,382
Lee	746	$24,155
Frontier	656	$21,881
Orange	593	$21,809
Granby	781	$18,824
Clarksburg	262	$15,078
Amherst	1,135	$31,267
Berkshire Hills	1,291	$30,257

District	2024 FTE	2024 PPE ▼
Amherst-Pelham	1,356	$28,233
Mohawk Trail	951	$27,124
Gill-Montague	1,127	$26,345
North Adams	1,447	$26,300
Gateway	847	$25,430
Lenox	814	$23,944
Palmer	1,234	$23,154
Monson	910	$22,675
Hoosac Valley Regional	1,240	$22,450
Mount Greylock	1,269	$21,705
Ware	1,310	$20,348
Southwick-Tolland-Granville Regional School District	1,432	$20,311
Holyoke	6,165	$24,619
Greenfield	1,869	$24,237
Pittsfield	5,806	$23,739
Chicopee	7,530	$22,866
Northampton	2,846	$21,267
Agawam	3,691	$20,920
Ludlow	2,377	$19,928
South Hadley	1,950	$19,810
Central Berkshire	1,787	$19,773
East Longmeadow	2,600	$19,444
Westfield	5,162	$19,236
Athol-Royalston	1,887	$18,981
West Springfield	4,245	$18,760
Hampden-Wilbraham	2,950	$18,436
Belchertown	2,265	$17,887
Longmeadow	2,826	$17,710
Easthampton	1,712	$17,371
Springfield	29,468	$26,615

Section 1 — Western MA traditional public school district trends

Geographic map showing district locations and enrollment cohorts (2024)

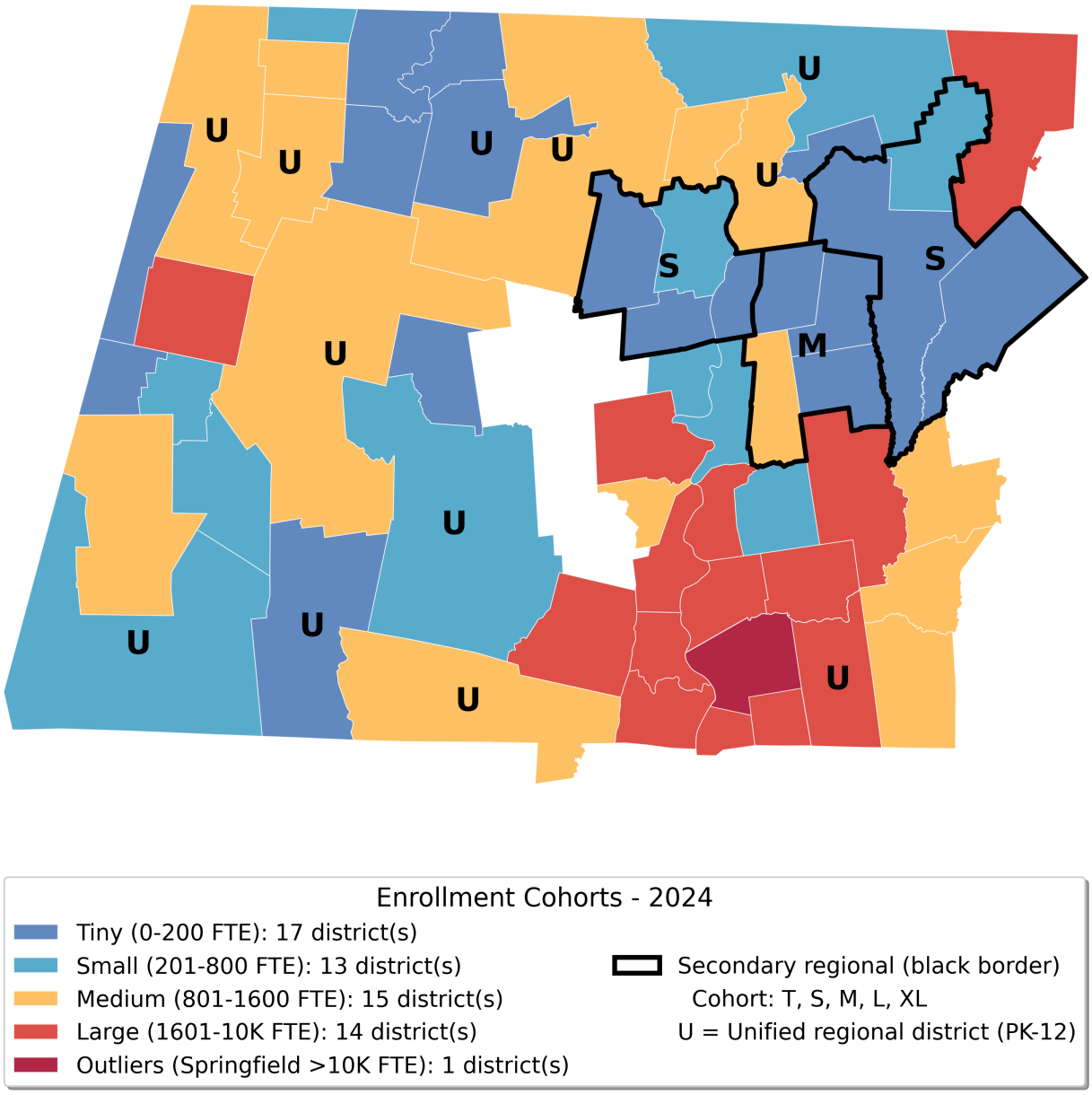

Figure 8

Geography matters for understanding school costs. This map shows where enrollment cohorts cluster and how regional district boundaries cross municipal lines.

Section 1 — Western MA traditional public school district trends

Geographic map showing 2024 PPE vs enrollment cohort baseline

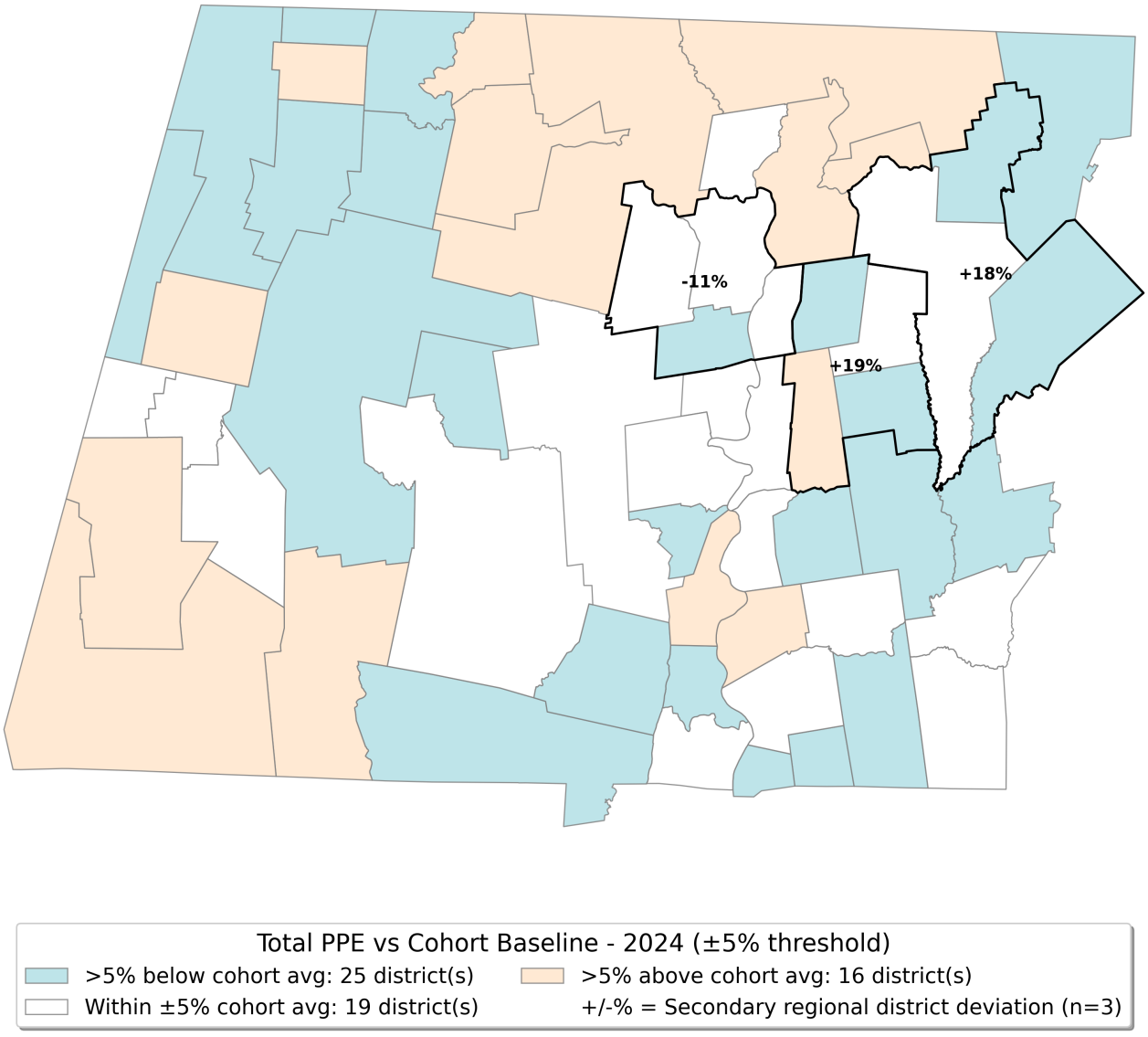

Figure 9

This map shows each district's 2024 per-pupil spending compared to its enrollment cohort baseline (weighted average of all Western MA districts in that cohort).

Section 1 — Western MA traditional public school district trends

Geographic map showing 15-year PPE growth (2009-2024) vs enrollment cohort baseline

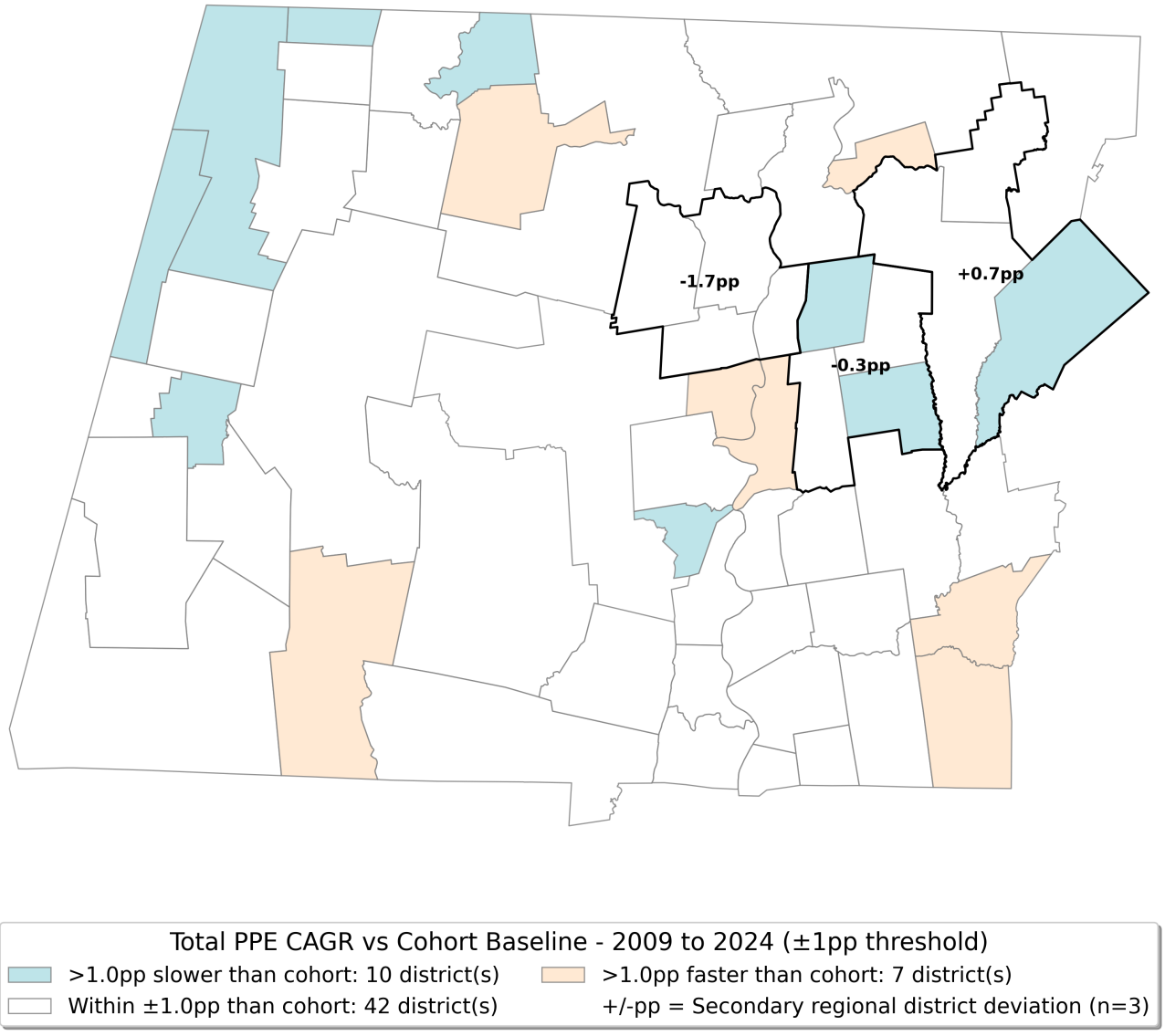

Figure 10

This map shows each district's 15-year spending growth rate (CAGR, 2009-2024) compared to its enrollment cohort baseline growth rate.

Section 2 — Western MA cohort details

Section 2 provides detailed per-pupil expenditure (PPE) and Net School Spending (NSS) analysis for Western Massachusetts enrollment cohorts: Tiny, Small, Medium, Large, and Springfield. Each cohort section includes:

- Aggregate **expenditure trends by category** (instruction, administration, operations, etc.)
- Aggregate **Chapter 70 aid** and **NSS** patterns over time
- **Enrollment-weighted averages** that represent typical spending across all districts in each cohort

These cohort pages serve as regional baselines for understanding cost patterns by district size.

To skip to **Section 3 — Selected districts**, turn to page 28.

Section 2 — Western MA cohort details

Tiny (0-200 FTE) — PPE vs Enrollment — Weighted average per district.

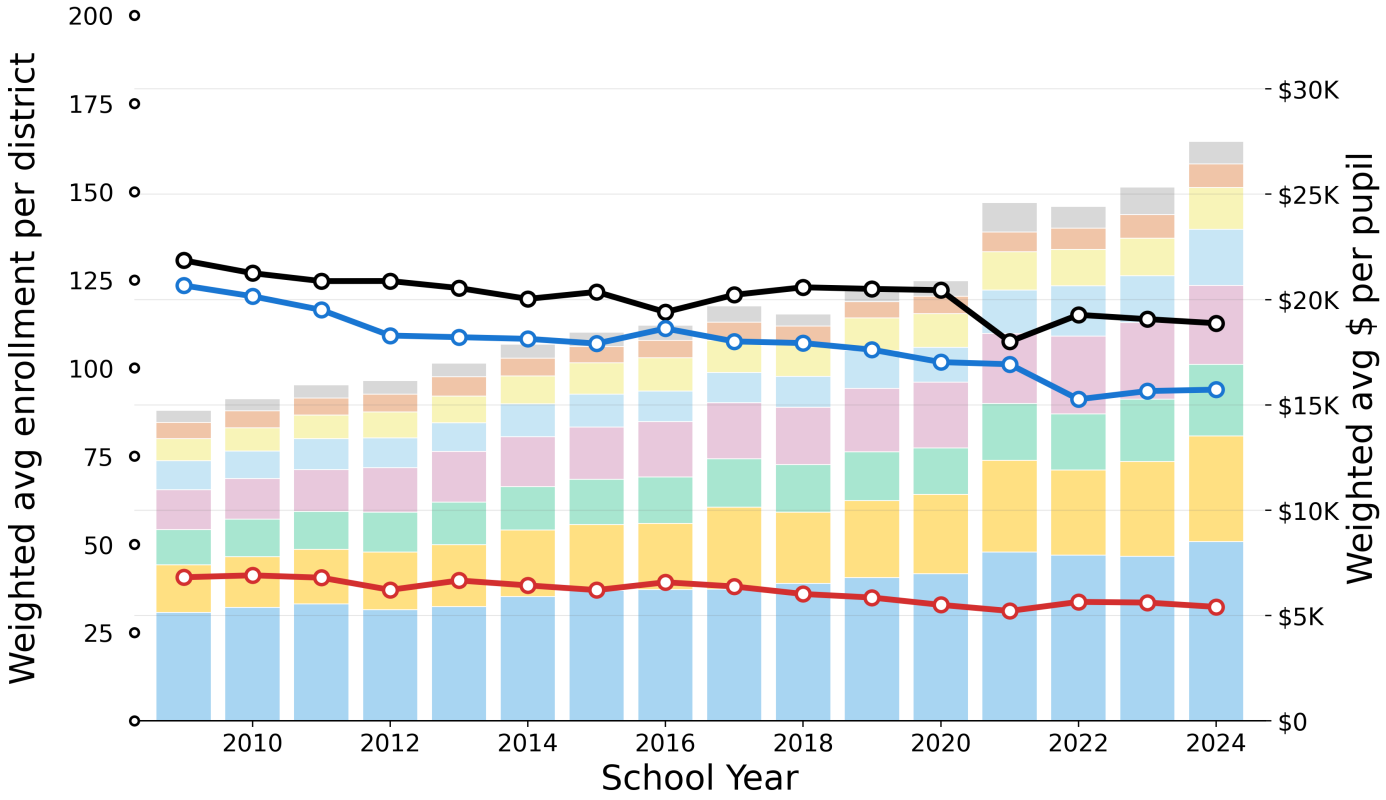

Figure 11

Table 5

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$577	+4.1%	+4.7%	+9.4%	$1,057
Administration	$770	+2.6%	+2.8%	+7.9%	$1,126
Instructional Leadership	$1,042	+4.4%	+4.2%	+5.2%	$1,991
Operations and Maintenance	$1,374	+4.5%	+5.5%	+7.9%	$2,652
Other Teaching Services	$1,899	+4.7%	+4.7%	+4.6%	$3,757
Pupil Services	$1,669	+4.9%	+5.2%	+8.0%	$3,406
Insurance, Retirement and Other	$2,258	+5.5%	+4.8%	+6.5%	$5,009
Teachers	$5,148	+3.4%	+3.7%	+4.6%	$8,507
Total	$14,738	+4.2%	+4.4%	+6.0%	$27,504

Table 6

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	131	-1.0%	-0.6%	-1.6%	113
Foundation Enrollment	123	-1.8%	-1.4%	-2.3%	94
Out-of-District FTE Pupils	41	-1.5%	-1.7%	-1.6%	32

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1

Below Western MA baseline

Section 2 — Western MA cohort details

Tiny (0-200 FTE) — Chapter 70 Aid and Net School Spending (NSS).

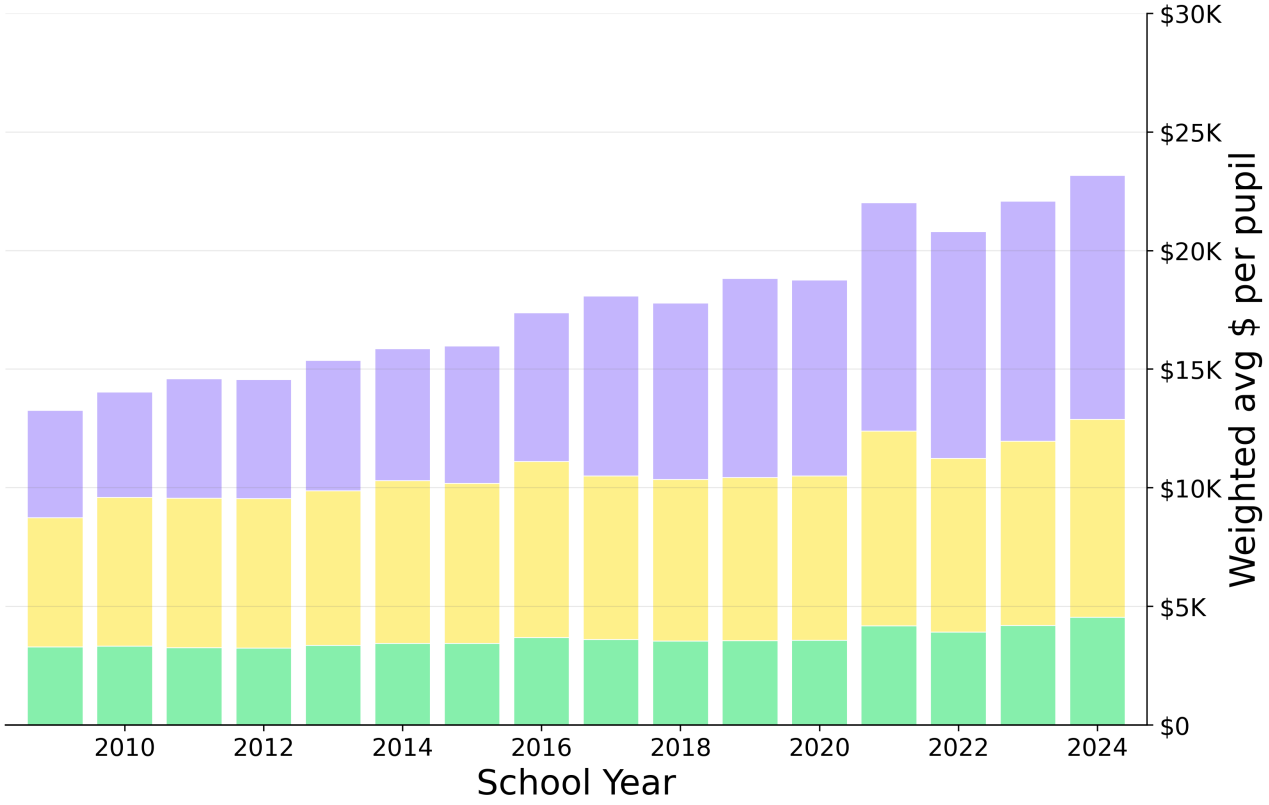

Figure 12

Table 7

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$4,523	5.63%	6.32%	4.13%	$10,285
Req NSS (minus Ch70)	$5,438	2.89%	1.98%	3.95%	$8,338
Ch70 Aid	$3,297	2.17%	2.82%	5.02%	$4,547
Total (Actual NSS)	$13,258	3.79%	3.86%	4.23%	$23,170

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp — Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1 — Below Western MA baseline

Tiny (0-200 FTE) includes 17 members:

Districts (15): Conway, Erving, Florida, Hancock, Hawlemont, Leverett, Pelham, Petersham, Richmond, Rowe, Savoy, Shutesbury, Sunderland, Whately, Worthington.

Regions (2): Farmington River Reg, New Salem-Wendell.

Section 2 — Western MA cohort details

Small (201-800 FTE) — PPE vs Enrollment — Weighted average per district.

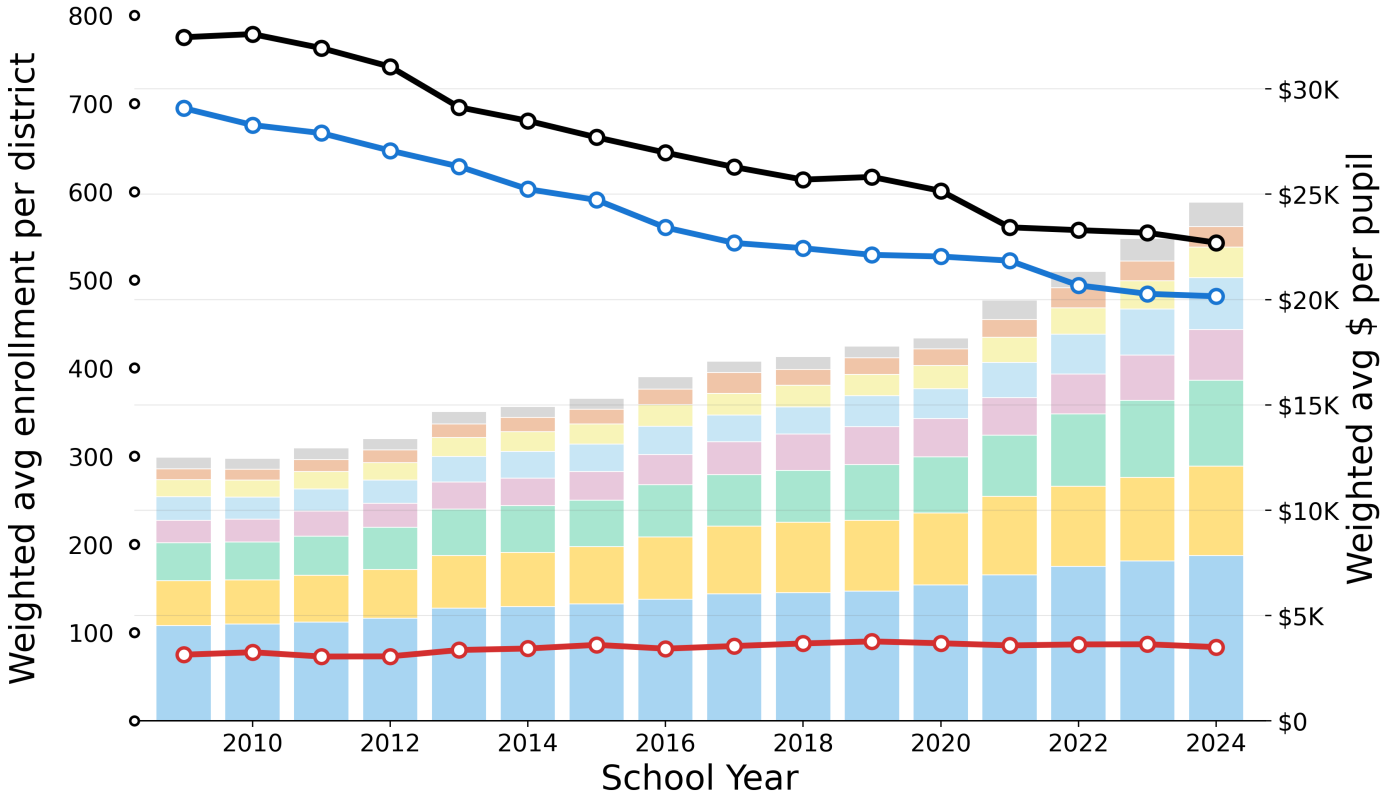

Figure 13

Table 8

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$558	+4.9%	+8.4%	+15.6%	$1,150
Administration	$523	+4.3%	+3.9%	+4.4%	$976
Instructional Leadership	$811	+4.0%	+4.4%	+7.6%	$1,463
Operations and Maintenance	$1,108	+5.4%	+6.9%	+10.8%	$2,454
Other Teaching Services	$1,061	+5.6%	+6.2%	+6.0%	$2,402
Pupil Services	$1,813	+5.6%	+6.3%	+9.1%	$4,084
Insurance, Retirement and Other	$2,128	+4.7%	+5.2%	+4.8%	$4,254
Teachers	$4,522	+3.7%	+3.8%	+5.0%	$7,838
Total	$12,523	+4.6%	+5.1%	+6.7%	$24,622

Table 9

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	775	-2.4%	-2.2%	-2.5%	542
Foundation Enrollment	695	-2.4%	-2.2%	-1.8%	481
Out-of-District FTE Pupils	75	+0.7%	+0.2%	-1.5%	84

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

CAGR = (End/Start)^(1/years) – 1

Above Western MA baseline

Below Western MA baseline

Section 2 — Western MA cohort details

Small (201-800 FTE) — Chapter 70 Aid and Net School Spending (NSS).

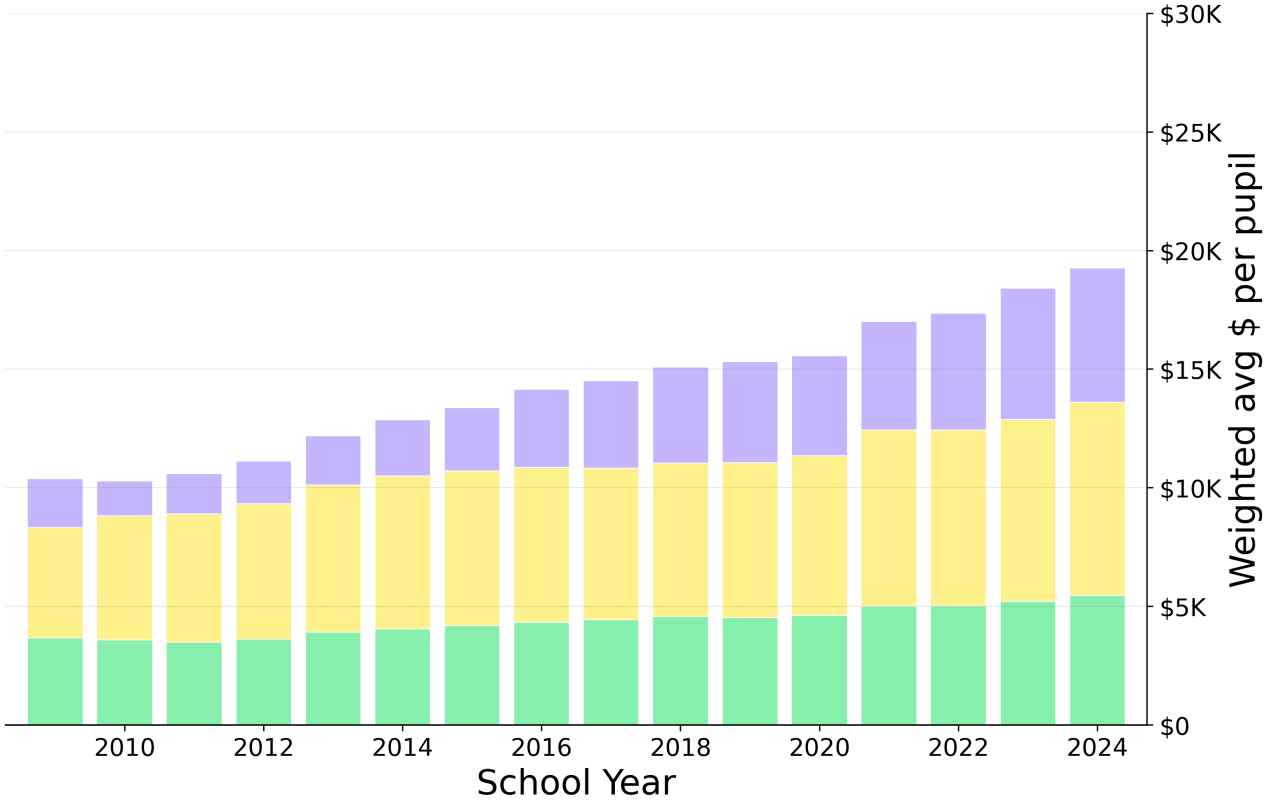

Figure 14

Table 10

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$2,054	6.98%	9.11%	5.86%	$5,656
Req NSS (minus Ch70)	$4,657	3.79%	2.35%	4.52%	$8,139
Ch70 Aid	$3,672	2.69%	3.05%	3.81%	$5,465
Total (Actual NSS)	$10,384	4.20%	4.12%	4.69%	$19,261

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

CAGR = (End/Start)^(1/years) – 1

Above Western MA baseline

Below Western MA baseline

Small (201-800 FTE) includes 13 members:

Districts (13): Clarksburg, Deerfield, Frontier, Gateway, Granby, Hadley, Hatfield, Lee, Lenox, Orange, Pioneer Valley, Ralph C Mahar, Southern Berkshire.

Section 2 — Western MA cohort details

Medium (801-1600 FTE) — PPE vs Enrollment — Weighted average per district.

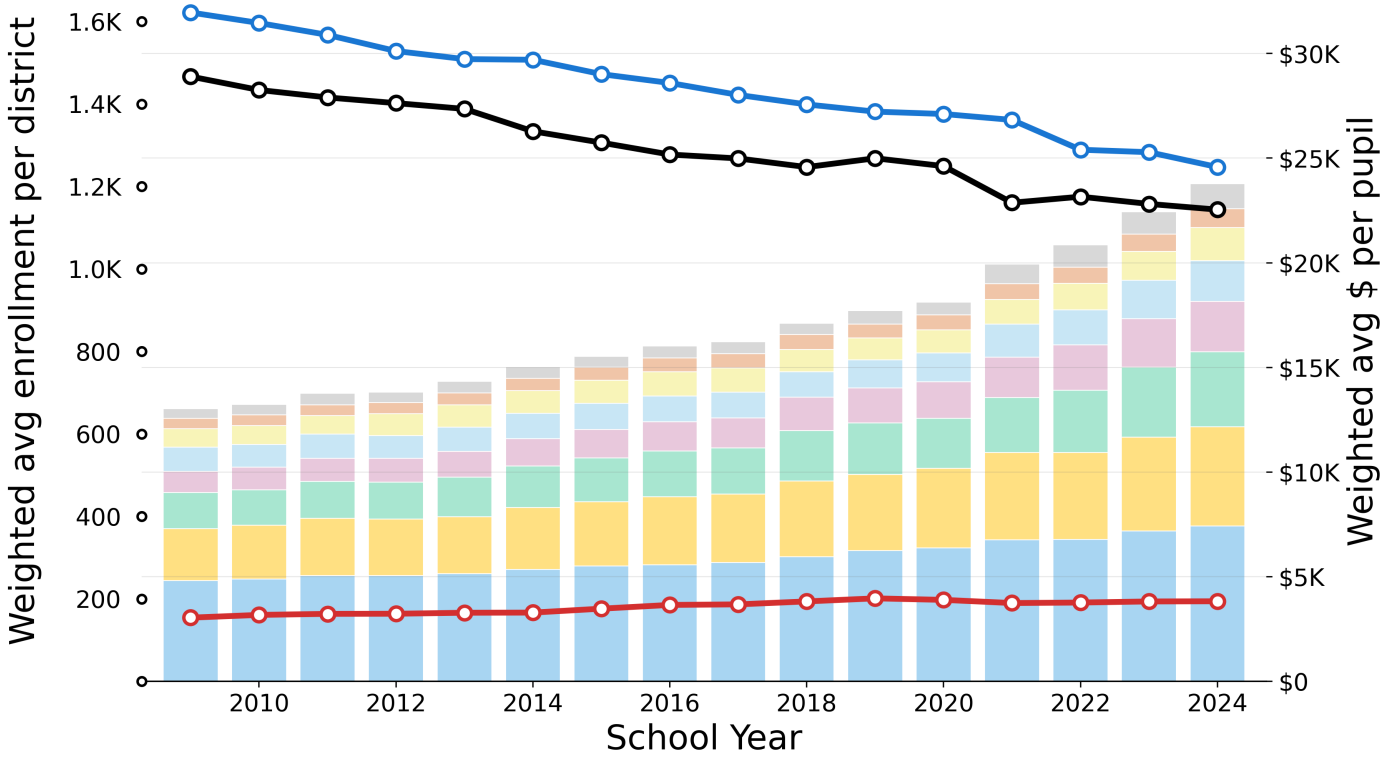

Figure 15

Table 11

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$461	+6.6%	+8.1%	+13.3%	$1,200
Administration	$494	+4.2%	+4.7%	+6.9%	$911
Instructional Leadership	$893	+3.8%	+3.7%	+8.2%	$1,573
Operations and Maintenance	$1,150	+3.6%	+4.9%	+8.0%	$1,953
Other Teaching Services	$1,014	+5.9%	+6.2%	+7.3%	$2,395
Pupil Services	$1,724	+5.0%	+6.1%	+7.8%	$3,581
Insurance, Retirement and Other	$2,483	+4.4%	+4.9%	+5.5%	$4,740
Teachers	$4,813	+2.9%	+3.3%	+3.5%	$7,431
Total	$13,032	+4.1%	+4.7%	+6.1%	$23,785

Table 12

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	1,466	-1.6%	-1.5%	-2.0%	1,144
Foundation Enrollment	1,622	-1.7%	-1.9%	-2.0%	1,247
Out-of-District FTE Pupils	154	+1.5%	+1.5%	-0.7%	194

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1

Below Western MA baseline

Section 2 — Western MA cohort details

Medium (801-1600 FTE) — Chapter 70 Aid and Net School Spending (NSS).

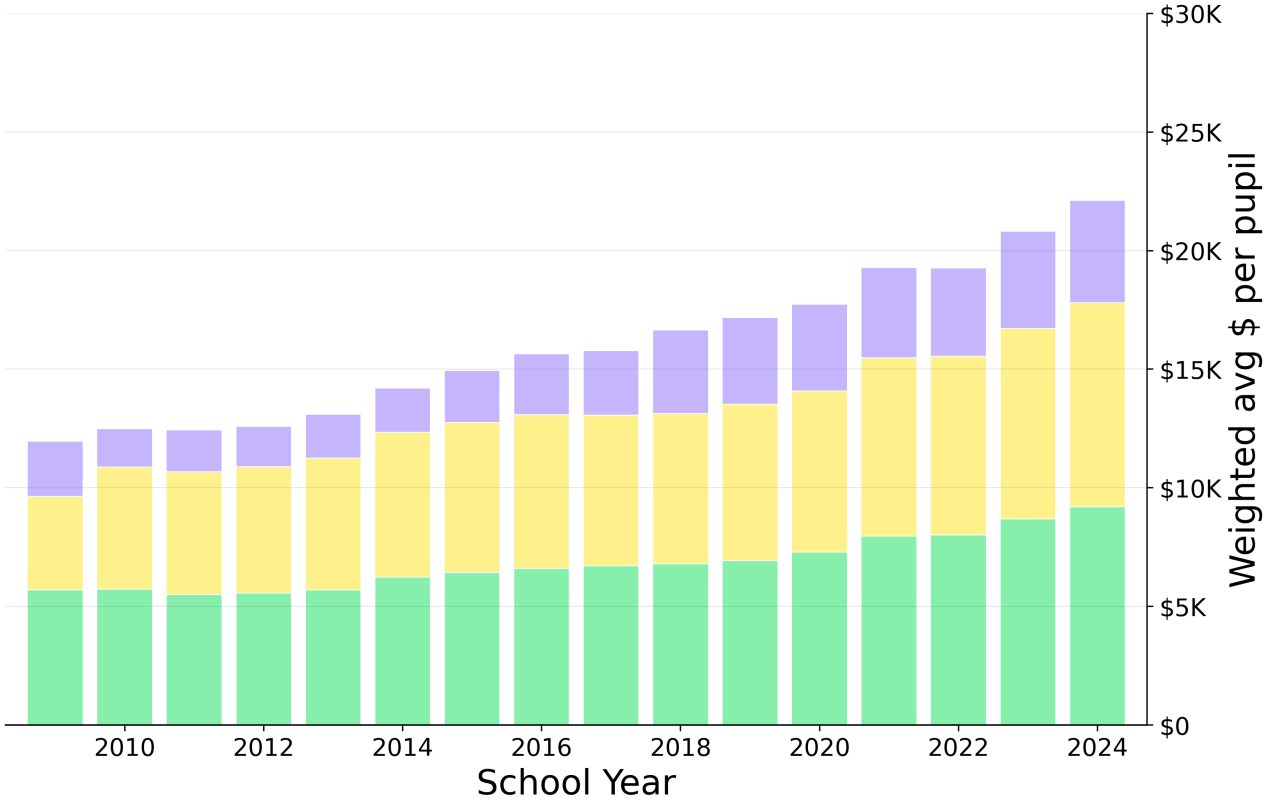

Figure 16

Table 13

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$2,318	4.23%	8.76%	3.35%	$4,315
Req NSS (minus Ch70)	$3,945	5.34%	3.49%	5.50%	$8,605
Ch70 Aid	$5,698	3.25%	3.97%	5.82%	$9,202
Total (Actual NSS)	$11,961	4.18%	4.53%	5.19%	$22,121

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp — Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1 — Below Western MA baseline

Medium (801-1600 FTE) includes 15 members:

Districts (11): Amherst, Berkshire Hills, Central Berkshire, Easthampton, Greenfield, Mohawk Trail, Monson, Mount Greylock, North Adams, Palmer, Ware.

Regions (4): Amherst-Pelham, Gill-Montague, Hoosac Valley Regional, Southwick-Tolland-Granville Regional School District.

Section 2 — Western MA cohort details

Large (1601-10K FTE) — PPE vs Enrollment — Weighted average per district.

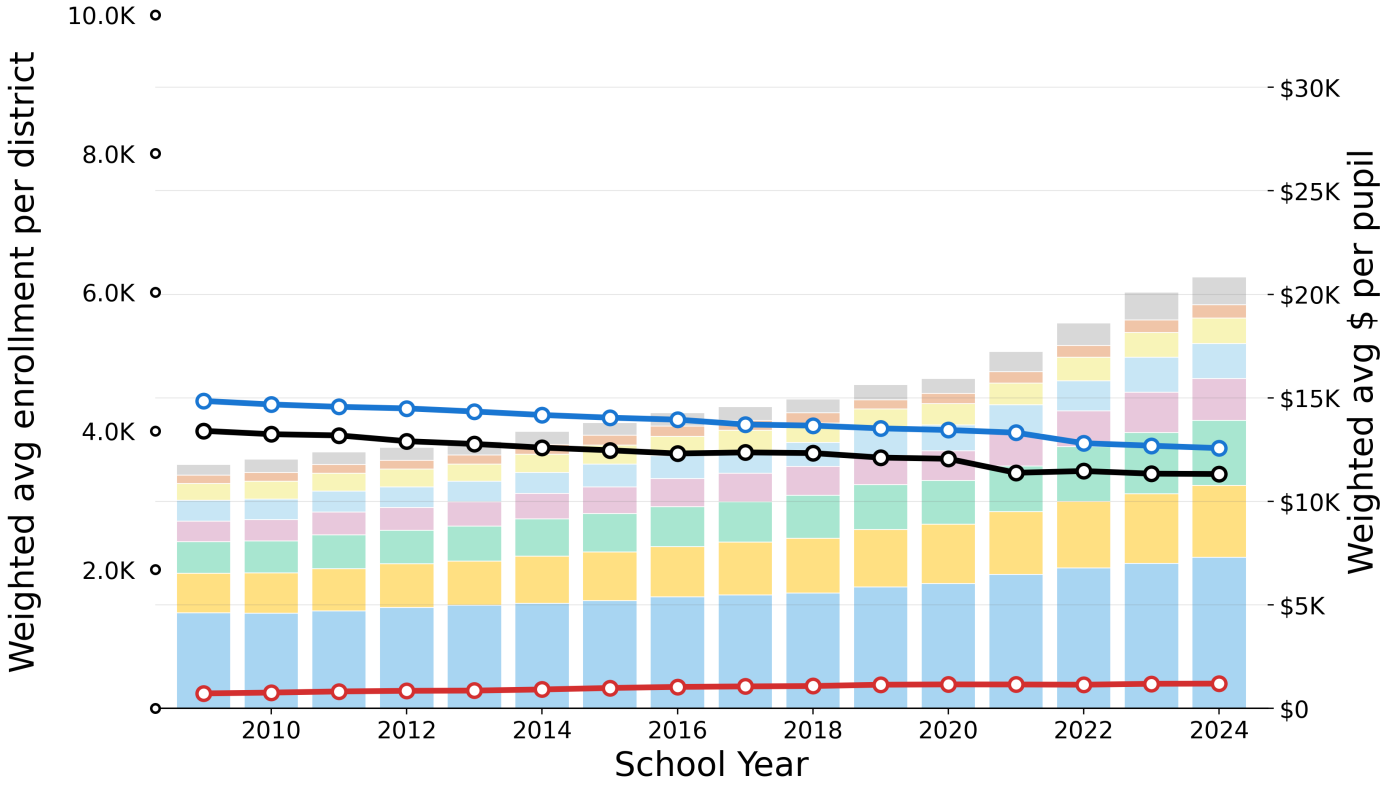

Figure 17

Table 14

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$513	+6.6%	+7.9%	+13.3%	$1,348
Administration	$392	+3.4%	+3.5%	+7.5%	$649
Instructional Leadership	$811	+2.8%	+3.3%	+4.3%	$1,231
Operations and Maintenance	$1,014	+3.4%	+5.1%	+6.2%	$1,683
Other Teaching Services	$990	+4.9%	+5.1%	+7.5%	$2,021
Pupil Services	$1,531	+4.9%	+5.8%	+7.7%	$3,148
Insurance, Retirement and Other	$1,911	+4.1%	+4.3%	+4.6%	$3,469
Teachers	$4,613	+3.1%	+3.7%	+4.5%	$7,292
Total	$11,775	+3.9%	+4.5%	+5.9%	$20,841

Table 15

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	4,001	-1.1%	-1.1%	-1.3%	3,379
Foundation Enrollment	4,432	-1.1%	-1.2%	-1.5%	3,752
Out-of-District FTE Pupils	215	+3.4%	+2.7%	+0.9%	357

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1

Below Western MA baseline

Section 2 — Western MA cohort details

Large (1601-10K FTE) — Chapter 70 Aid and Net School Spending (NSS).

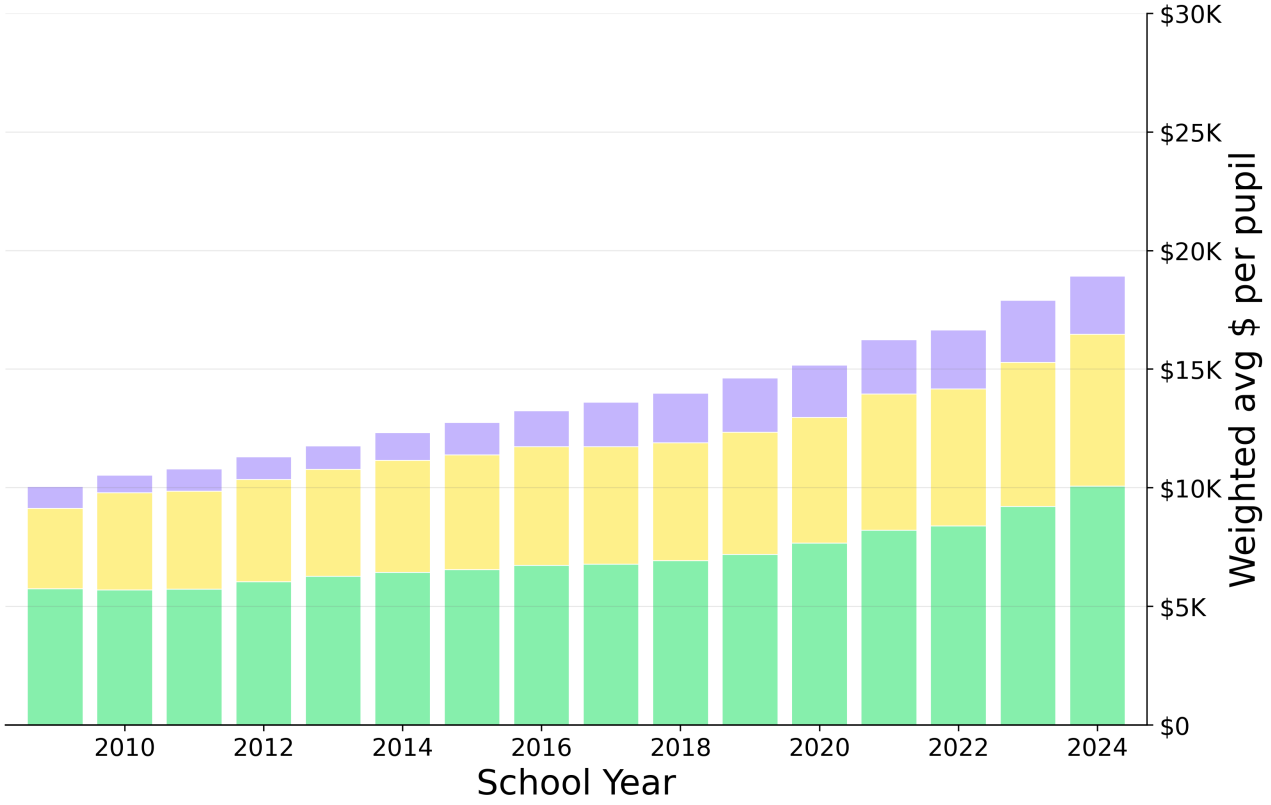

Figure 18

Table 16

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$934	6.66%	7.71%	1.41%	$2,455
Req NSS (minus Ch70)	$3,385	4.35%	3.11%	4.46%	$6,407
Ch70 Aid	$5,742	3.81%	4.57%	6.96%	$10,065
Total (Actual NSS)	$10,060	4.30%	4.39%	5.29%	$18,927

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

CAGR = (End/Start)^(1/years) – 1

Above Western MA baseline

Below Western MA baseline

Large (1601-10K FTE) includes 14 members:

Districts (12): Agawam, Belchertown, Chicopee, East Longmeadow, Holyoke, Longmeadow, Ludlow, Northampton, Pittsfield, South Hadley, West Springfield, Westfield.

Regions (2): Athol-Royalston, Hampden-Wilbraham.

Section 2 — Western MA cohort details

Outliers (Springfield >10K FTE) — PPE vs Enrollment — Weighted average per district.

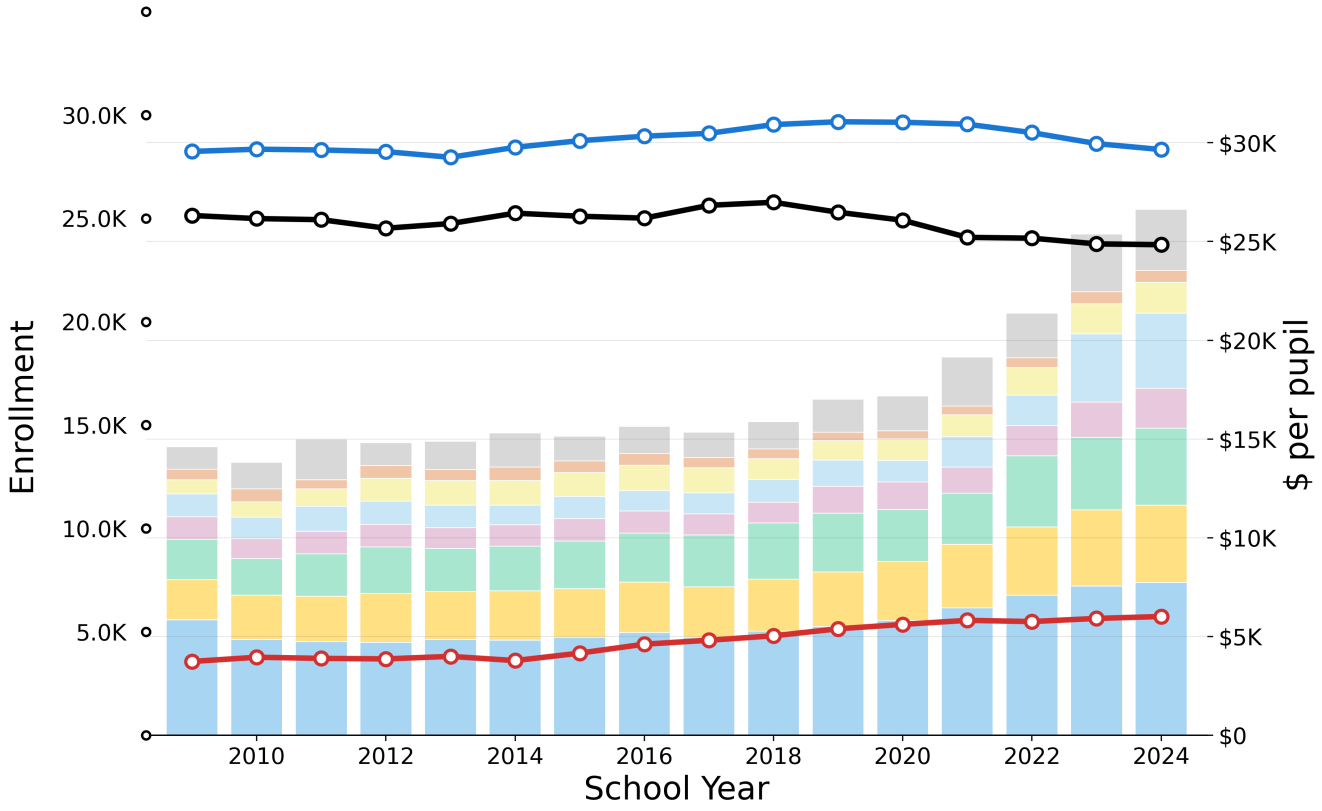

Figure 19

Table 17

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$1,143	+6.8%	+5.9%	+12.9%	$3,071
Administration	$533	+0.9%	-1.1%	+7.9%	$609
Instructional Leadership	$719	+5.3%	+2.4%	+9.8%	$1,571
Operations and Maintenance	$1,150	+8.3%	+14.3%	+23.3%	$3,806
Other Teaching Services	$1,143	+3.8%	+6.4%	+8.2%	$2,014
Pupil Services	$2,031	+4.4%	+5.6%	+5.6%	$3,901
Insurance, Retirement and Other	$2,050	+4.4%	+4.6%	+7.2%	$3,906
Teachers	$5,839	+1.9%	+4.8%	+7.0%	$7,737
Total	$14,608	+4.1%	+5.7%	+9.4%	$26,615

Table 18

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	25,137	-0.4%	-0.6%	-1.3%	23,723
Foundation Enrollment	28,235	+0.0%	-0.0%	-0.9%	28,326
Out-of-District FTE Pupils	3,571	+3.2%	+4.7%	+2.2%	5,745

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1

Below Western MA baseline

Section 2 — Western MA cohort details

Outliers (Springfield >10K FTE) — Chapter 70 Aid and Net School Spending (NSS).

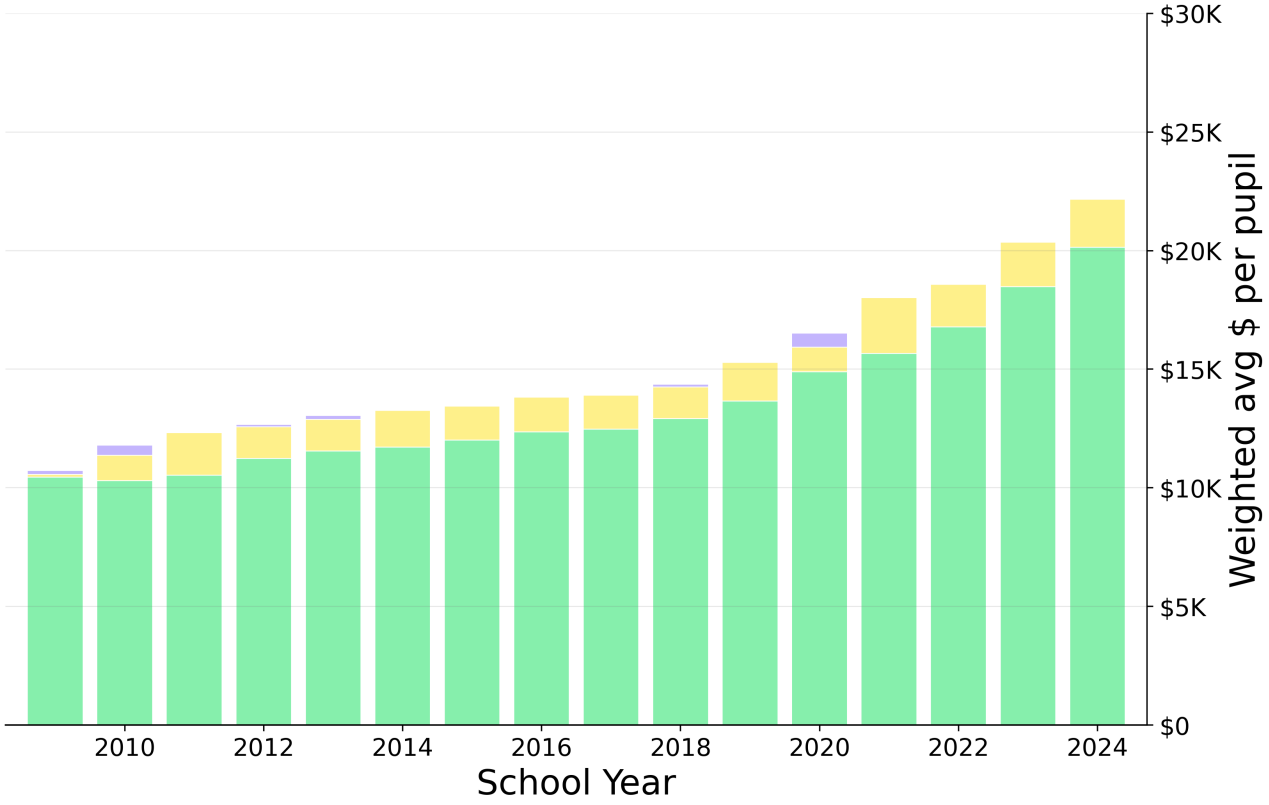

Figure 20

Table 19

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$-169	-59.51%	-52.40%	24.01%	$-0
Req NSS (minus Ch70)	$278	14.15%	2.69%	4.35%	$2,024
Ch70 Aid	$10,452	4.47%	5.57%	8.08%	$20,138
Total (Actual NSS)	$10,561	5.07%	5.26%	7.70%	$22,163

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp — Above Western MA baseline

CAGR = (End/Start)^(1/years) – 1 — Below Western MA baseline

Outliers (Springfield >10K FTE) includes 1 members:

Districts (1): Springfield.

Section 3 — Selected districts

Section 3 examines five selected districts in depth: Amherst-Pelham Regional, Amherst, Leverett, Pelham, and Shutesbury. For each district, three detailed pages show:

• Total PPE breakdown by **expenditure category** with shaded comparison to cohort baseline
• **Chapter 70 aid** and **Net School Spending** breakdown per pupil with shaded comparison to cohort baseline
• **CAGR over 5, 10, and 15-year periods** with shaded comparison to cohort baseline

These district-level pages enable direct comparison between individual district spending patterns and their respective cohorts. Note that although this section focuses on the five selected districts and Western MA, the same visualizations can be produced for other MA districts and regions.

To skip to **Appendix A: Data Sources & Calculation Methodology**, turn to page 39.

Report Navigation:

Section 3 — Specific districts

Amherst-Pelham Regional — PPE vs Enrollment

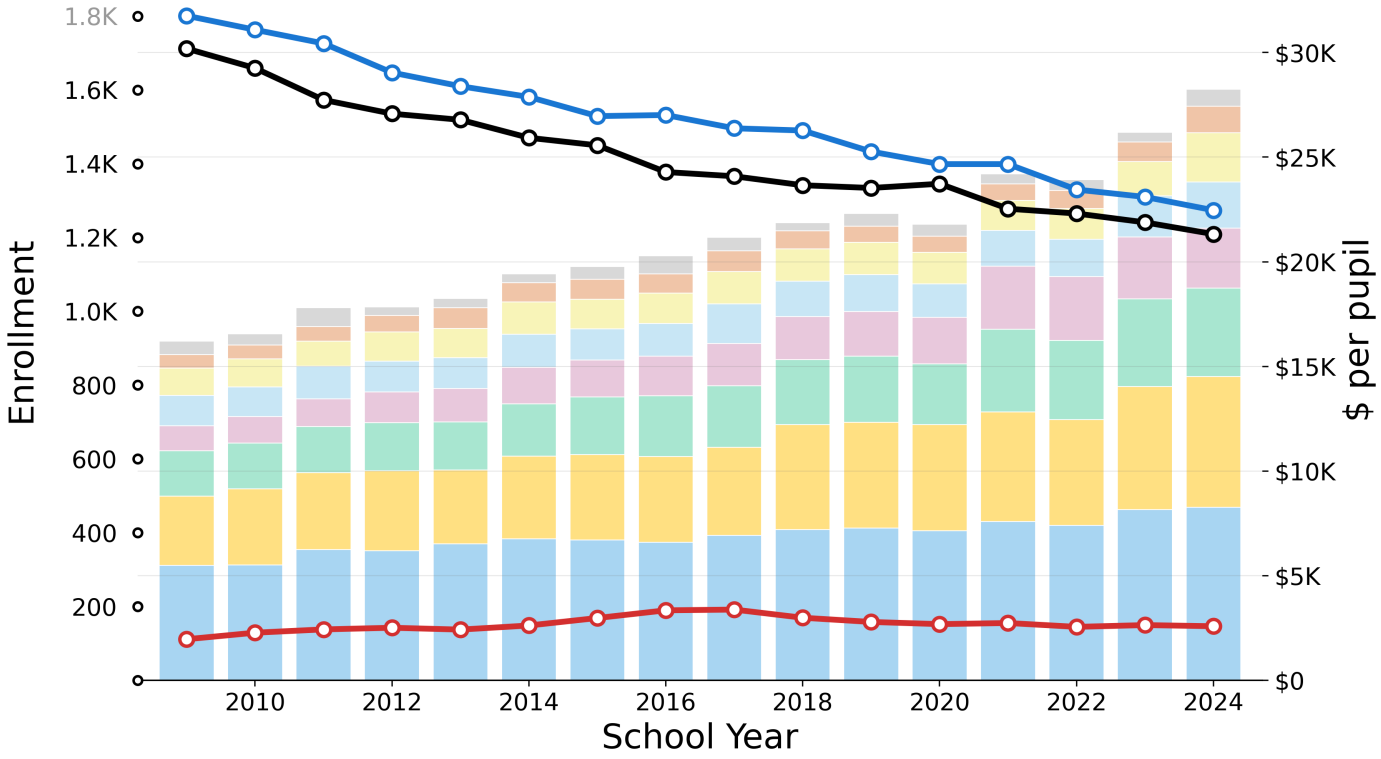

Figure 21

Table 20

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$646	+1.4%	+6.5%	+5.5%	$799
Administration	$652	+4.6%	+3.5%	+11.0%	$1,277
Instructional Leadership	$1,289	+4.0%	+4.2%	+8.6%	$2,336
Operations and Maintenance	$1,459	+2.8%	+3.4%	+4.6%	$2,221
Other Teaching Services	$1,199	+5.9%	+5.1%	+6.1%	$2,851
Pupil Services	$2,170	+4.6%	+5.4%	+6.0%	$4,231
Insurance, Retirement and Other	$3,305	+4.3%	+4.7%	+4.4%	$6,248
Teachers	$5,491	+2.8%	+2.0%	+2.6%	$8,270
Total	$16,211	+3.8%	+3.8%	+4.8%	$28,233

Table 21

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	1,712	-2.3%	-1.9%	-1.9%	1,209
Foundation Enrollment	1,801	-2.3%	-2.1%	-2.3%	1,274
Out-of-District FTE Pupils	112	+1.8%	-0.1%	-1.5%	147

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Medium (801-1600))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Medium (801-1600))

Section 3 — Selected districts

Amherst-Pelham Regional — Chapter 70 Aid and Net School Spending (NSS)

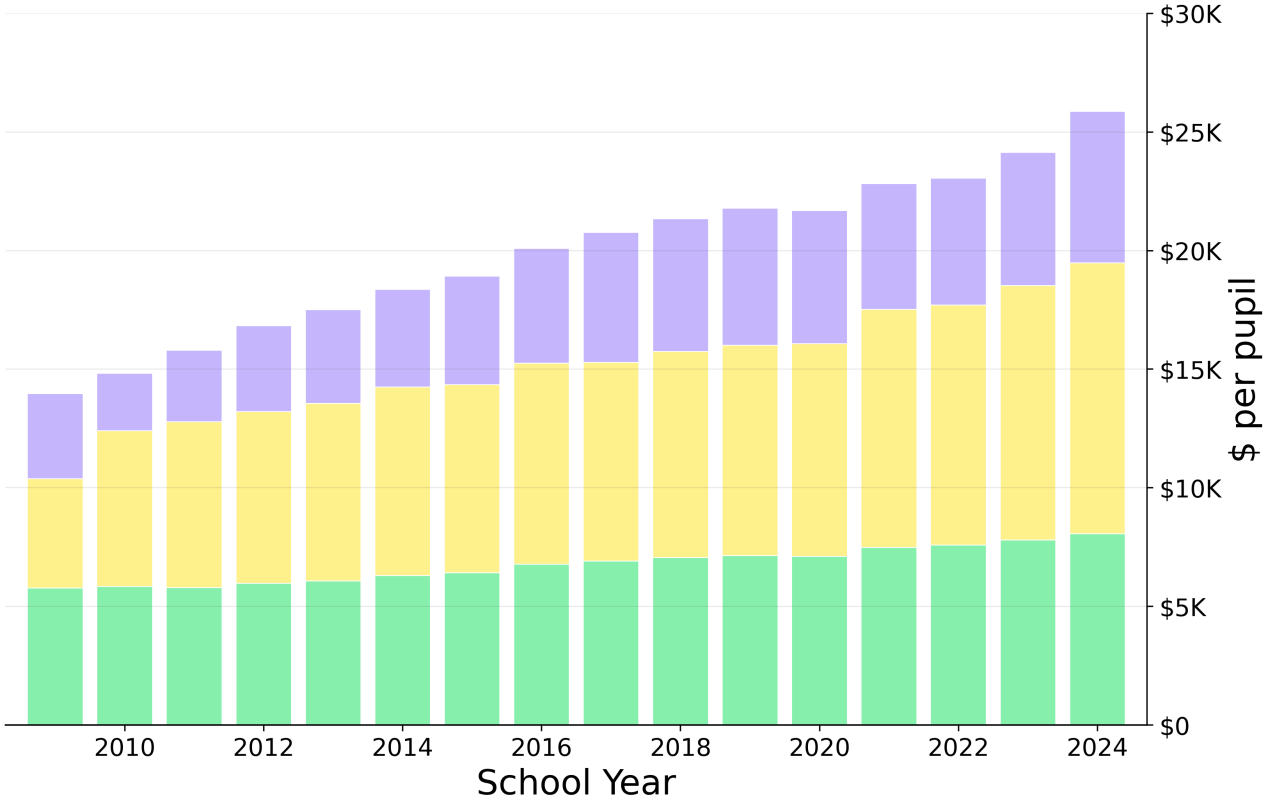

Figure 22

Table 22

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$3,584	3.92%	4.46%	2.07%	$6,383
Req NSS (minus Ch70)	$4,611	6.23%	3.70%	5.14%	$11,414
Ch70 Aid	$5,773	2.26%	2.49%	2.49%	$8,068
Total (Actual NSS)	$13,968	4.19%	3.48%	3.50%	$25,865

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

CAGR = (End/Start)^(1/years) – 1

Above cohort baseline (Medium (801-1600))

Below cohort baseline (Medium (801-1600))

Section 3 — Specific districts

Amherst — PPE vs Enrollment

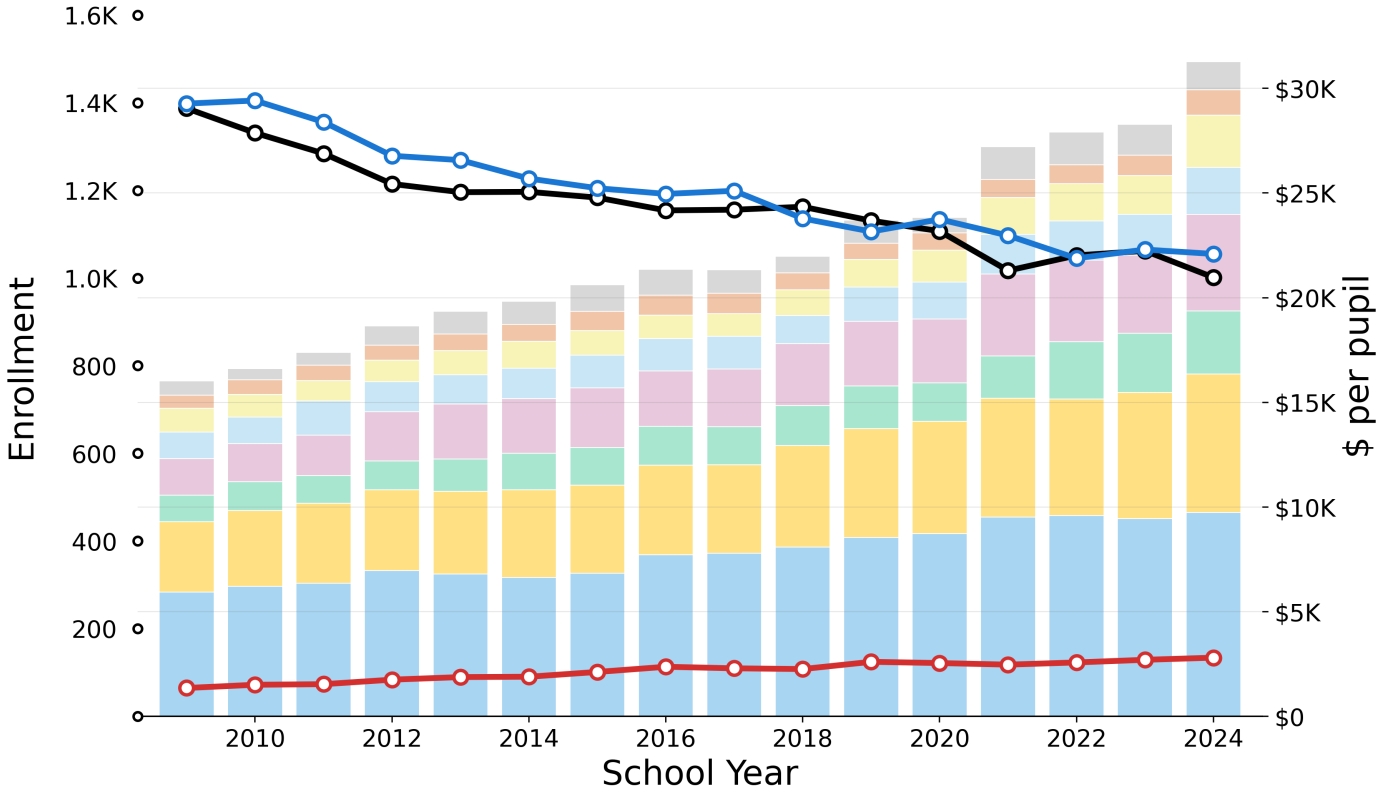

Figure 23

Table 23

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$684	+4.5%	+1.9%	+4.0%	$1,328
Administration	$627	+4.5%	+4.1%	+9.6%	$1,213
Instructional Leadership	$1,134	+5.4%	+7.0%	+13.5%	$2,498
Operations and Maintenance	$1,264	+3.9%	+4.5%	+6.4%	$2,248
Other Teaching Services	$1,762	+6.6%	+5.9%	+8.4%	$4,612
Pupil Services	$1,261	+6.0%	+5.5%	+8.3%	$3,018
Insurance, Retirement and Other	$3,353	+4.6%	+4.7%	+4.9%	$6,605
Teachers	$5,944	+3.4%	+3.9%	+2.7%	$9,745
Total	$16,029	+4.6%	+4.7%	+5.7%	$31,267

Table 24

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	1,387	-2.1%	-1.8%	-2.4%	1,002
Foundation Enrollment	1,398	-1.9%	-1.5%	-0.9%	1,055
Out-of-District FTE Pupils	65	+5.0%	+4.0%	+1.5%	134

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Medium (801-1600))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Medium (801-1600))

Section 3 — Selected districts

Amherst — Chapter 70 Aid and Net School Spending (NSS)

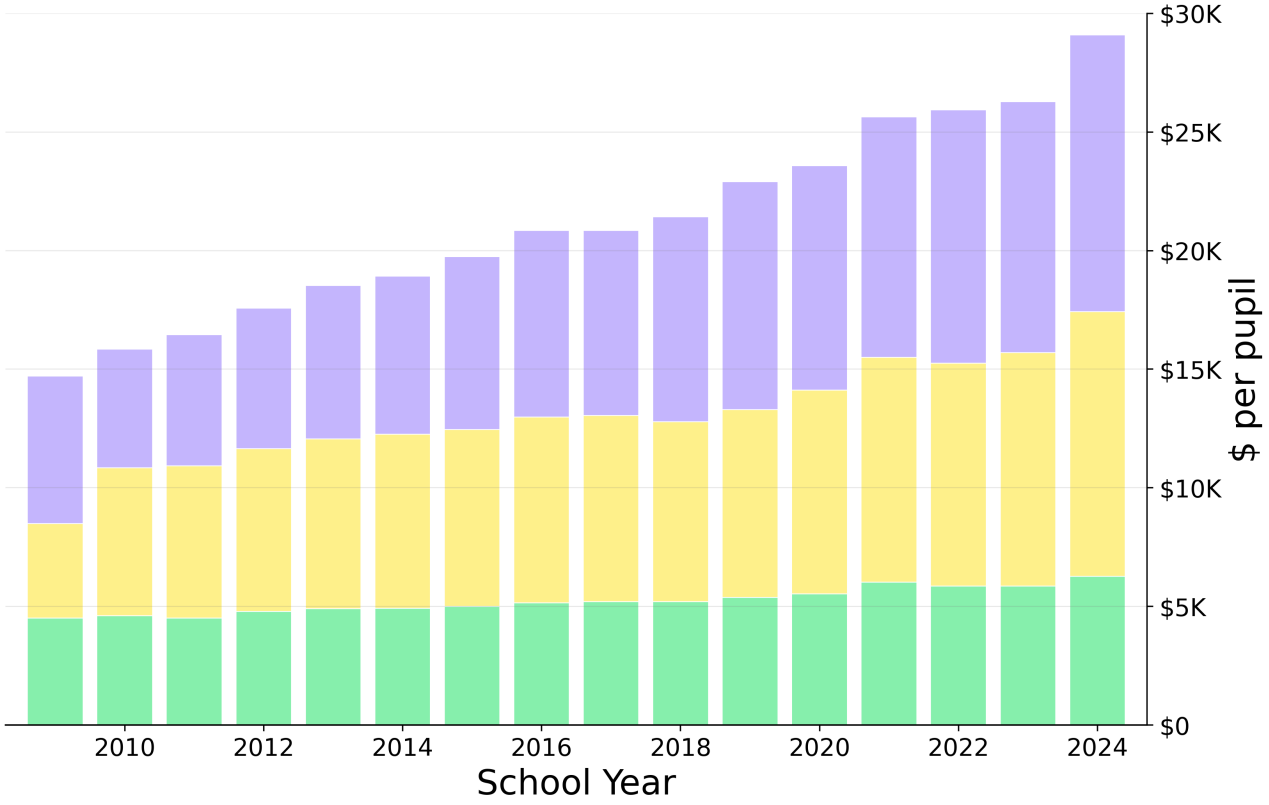

Figure 24

Table 25

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$6,217	4.29%	5.77%	3.94%	$11,670
Req NSS (minus Ch70)	$3,977	7.11%	4.27%	7.11%	$11,151
Ch70 Aid	$4,518	2.21%	2.44%	3.10%	$6,271
Total (Actual NSS)	$14,712	4.65%	4.39%	4.89%	$29,093

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Medium (801-1600))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Medium (801-1600))

Section 3 — Specific districts

Leverett — PPE vs Enrollment

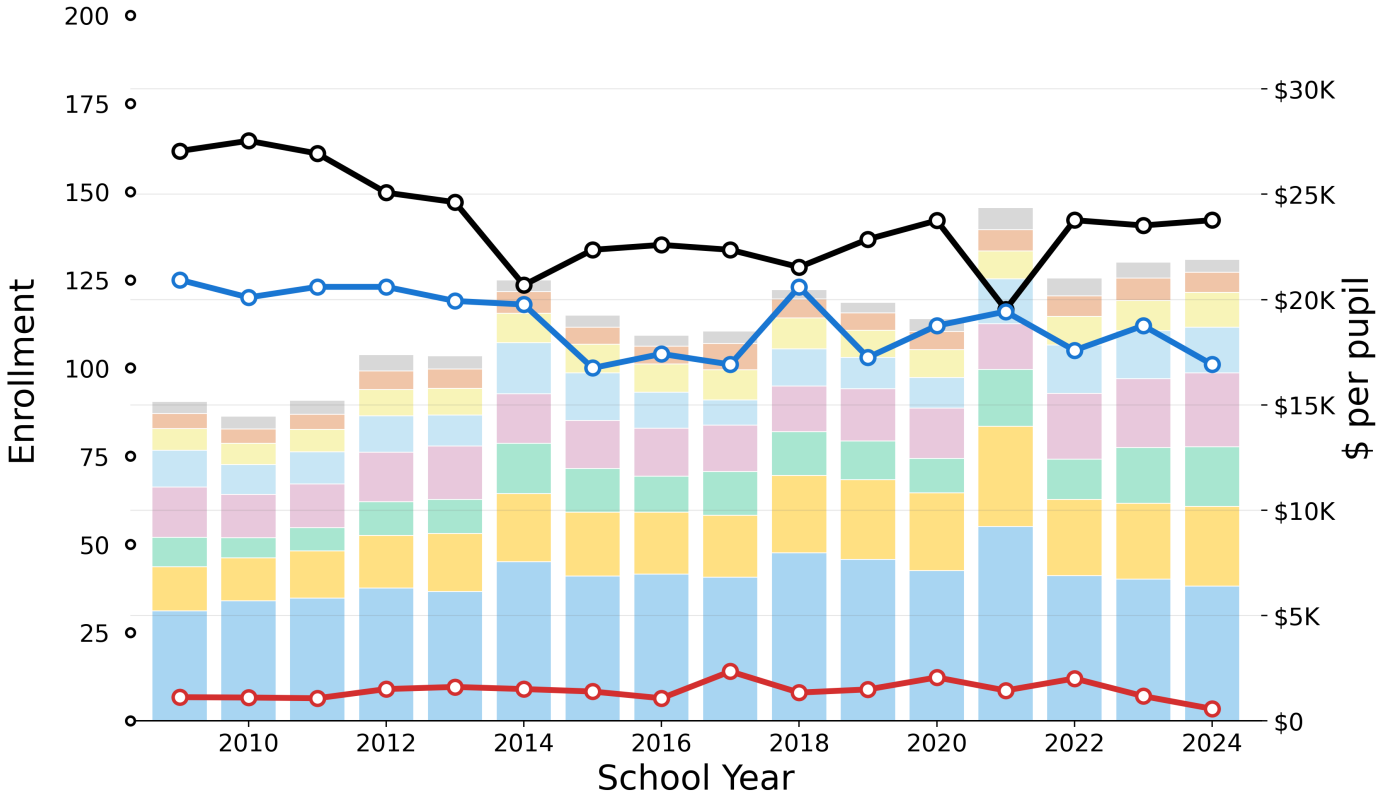

Figure 25

Table 26

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$575	+0.4%	+0.9%	+3.9%	$608
Administration	$715	+1.9%	-0.8%	+2.9%	$953
Instructional Leadership	$1,015	+3.3%	+1.8%	+5.4%	$1,663
Operations and Maintenance	$1,755	+1.4%	-1.1%	+7.7%	$2,158
Other Teaching Services	$2,385	+2.6%	+4.1%	+7.3%	$3,526
Pupil Services	$1,395	+4.8%	+1.6%	+8.8%	$2,814
Insurance, Retirement and Other	$2,098	+4.0%	+1.6%	+0.1%	$3,793
Teachers	$5,218	+1.4%	-1.6%	-3.6%	$6,395
Total	$15,156	+2.5%	+0.5%	+2.0%	$21,910

Table 27

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	162	-0.9%	+1.4%	+0.8%	142
Foundation Enrollment	125	-1.4%	-1.5%	-0.4%	101
Out-of-District FTE Pupils	7	-4.4%	-9.3%	-17.5%	3

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Tiny (0-200))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Tiny (0-200))

Section 3 — Selected districts

Leverett — Chapter 70 Aid and Net School Spending (NSS)

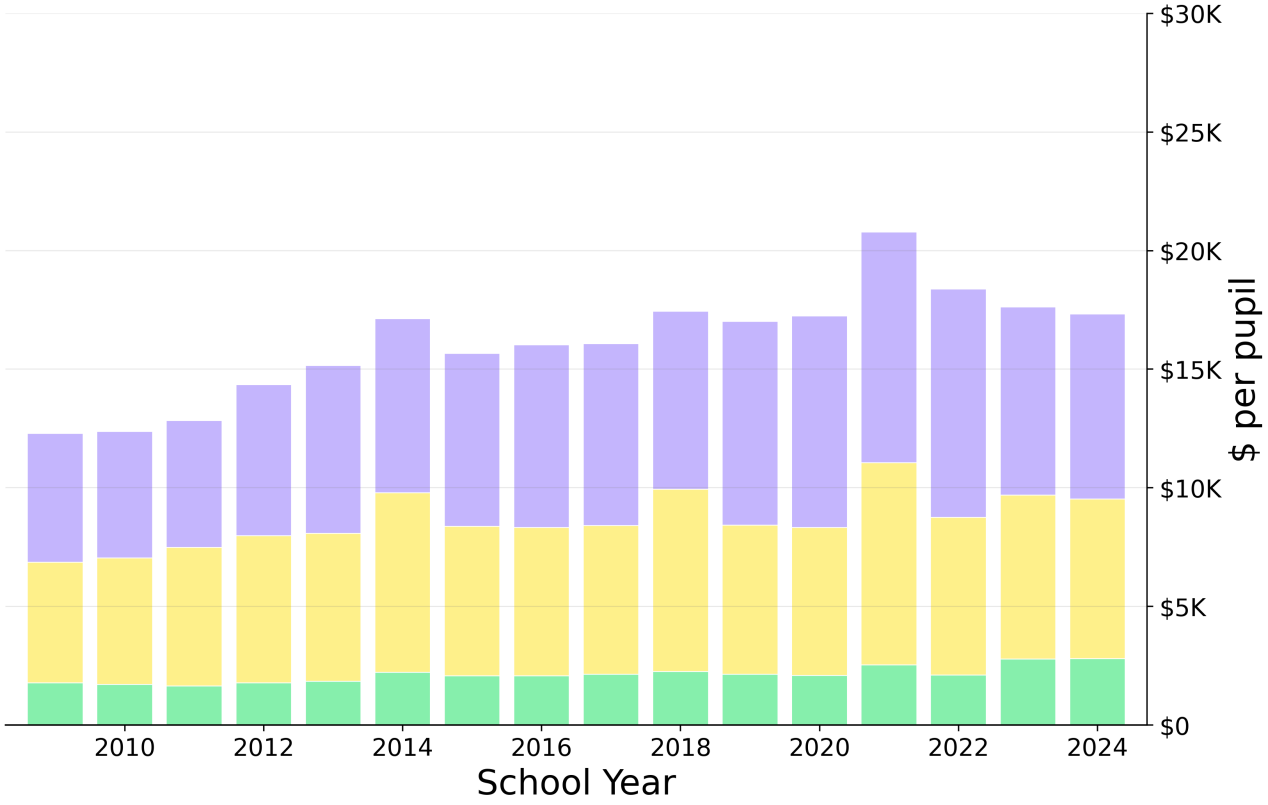

Figure 26

Table 28

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$5,429	2.44%	0.62%	-1.89%	$7,799
Req NSS (minus Ch70)	$5,074	1.90%	-1.17%	1.36%	$6,728
Ch70 Aid	$1,782	3.05%	2.32%	5.50%	$2,798
Total (Actual NSS)	$12,285	2.32%	0.12%	0.37%	$17,325

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Tiny (0-200))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Tiny (0-200))

Section 3 — Specific districts

Pelham — PPE vs Enrollment

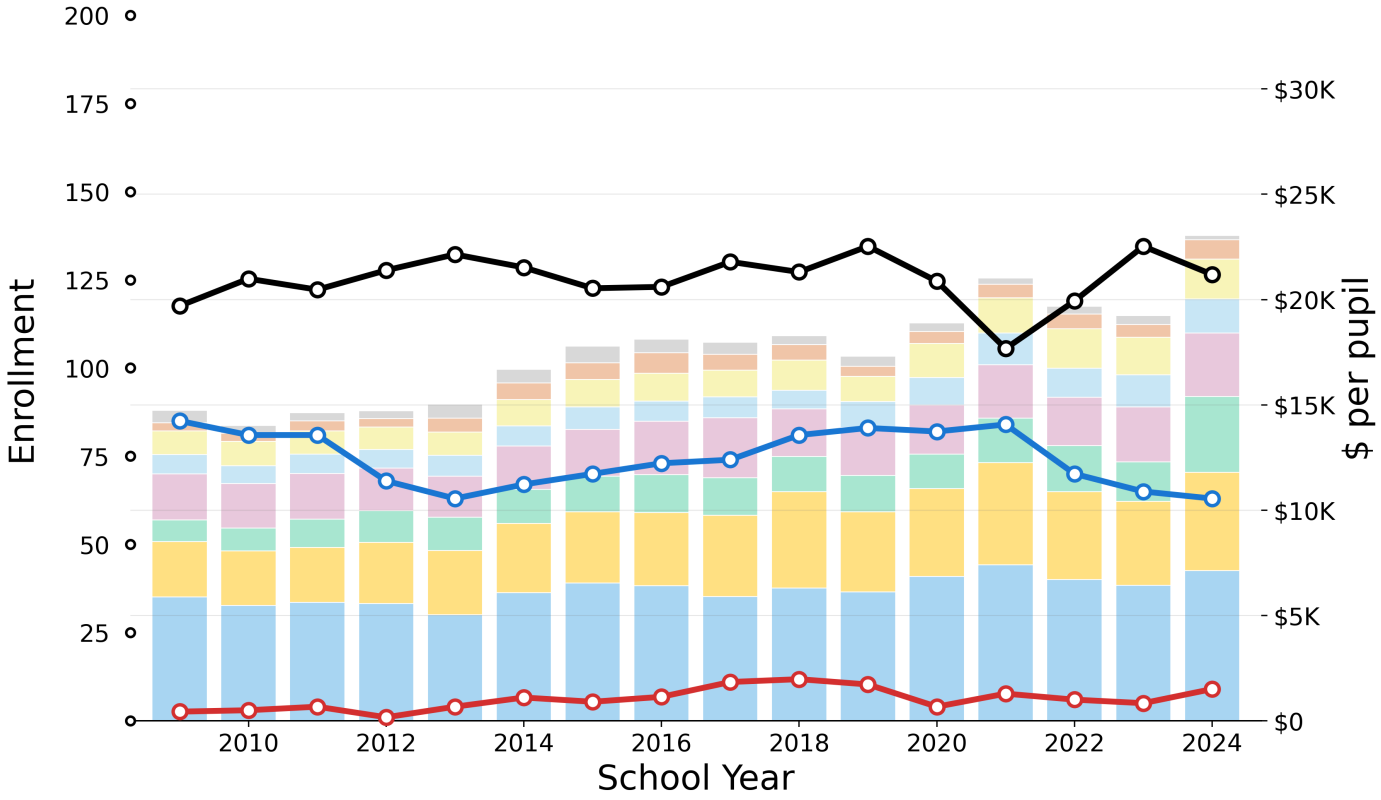

Figure 27

Table 29

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$580	-6.6%	-10.7%	-15.0%	$207
Administration	$390	+5.9%	+1.4%	+13.4%	$917
Instructional Leadership	$1,123	+3.5%	+4.2%	+9.6%	$1,885
Operations and Maintenance	$920	+3.8%	+5.5%	+5.6%	$1,614
Other Teaching Services	$2,184	+2.2%	+3.9%	+5.8%	$3,010
Pupil Services	$1,032	+8.7%	+8.4%	+15.8%	$3,610
Insurance, Retirement and Other	$2,615	+3.9%	+3.6%	+4.3%	$4,670
Teachers	$5,889	+1.3%	+1.6%	+3.1%	$7,127
Total	$14,733	+3.0%	+3.3%	+5.9%	$23,040

Table 30

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	118	+0.5%	-0.2%	-1.2%	126
Foundation Enrollment	85	-2.0%	-0.6%	-5.4%	63
Out-of-District FTE Pupils	3	+8.6%	+3.2%	-2.7%	9

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Tiny (0-200))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Tiny (0-200))

Section 3 — Selected districts

Pelham — Chapter 70 Aid and Net School Spending (NSS)

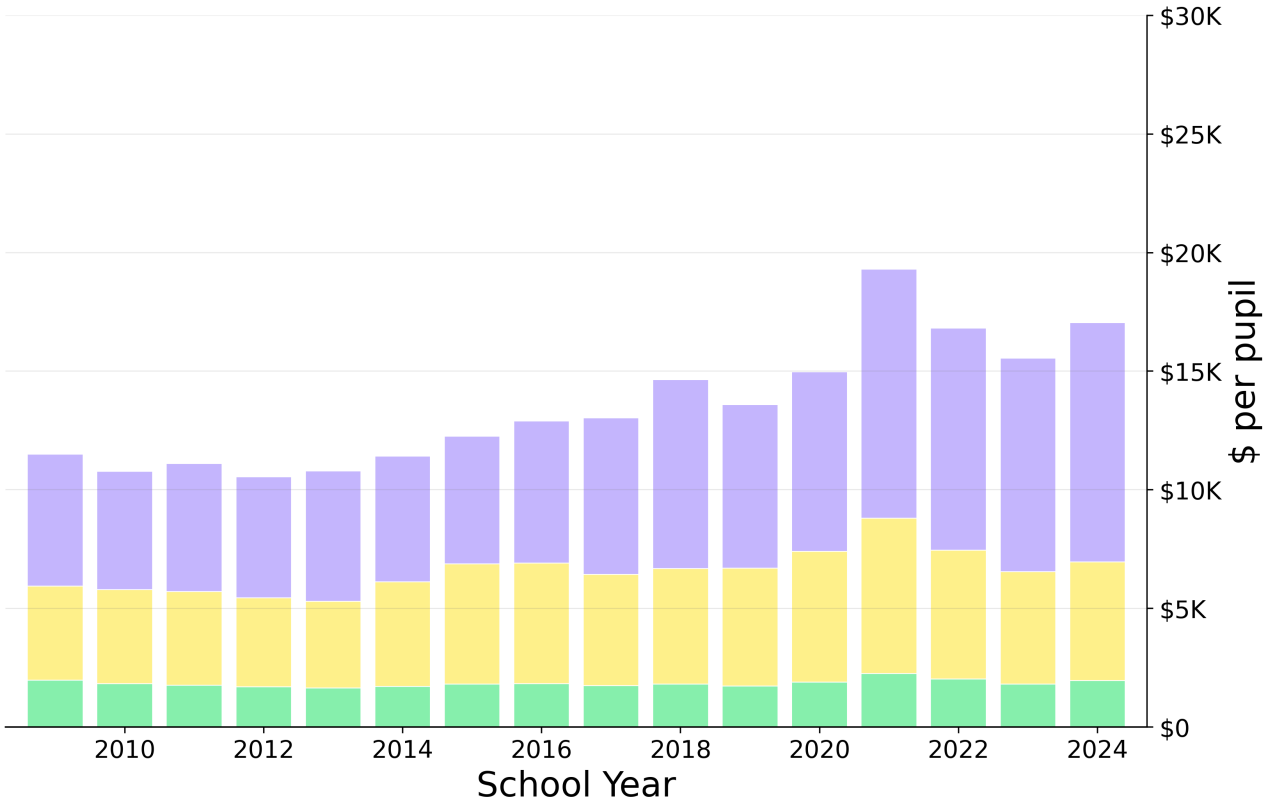

Figure 28

Table 31

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$5,561	4.05%	6.64%	7.91%	$10,086
Req NSS (minus Ch70)	$3,963	1.56%	1.26%	0.10%	$4,996
Ch70 Aid	$1,983	-0.07%	1.35%	2.52%	$1,963
Total (Actual NSS)	$11,507	2.65%	4.08%	4.62%	$17,044

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Tiny (0-200))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Tiny (0-200))

Section 3 — Specific districts

Shutesbury — PPE vs Enrollment

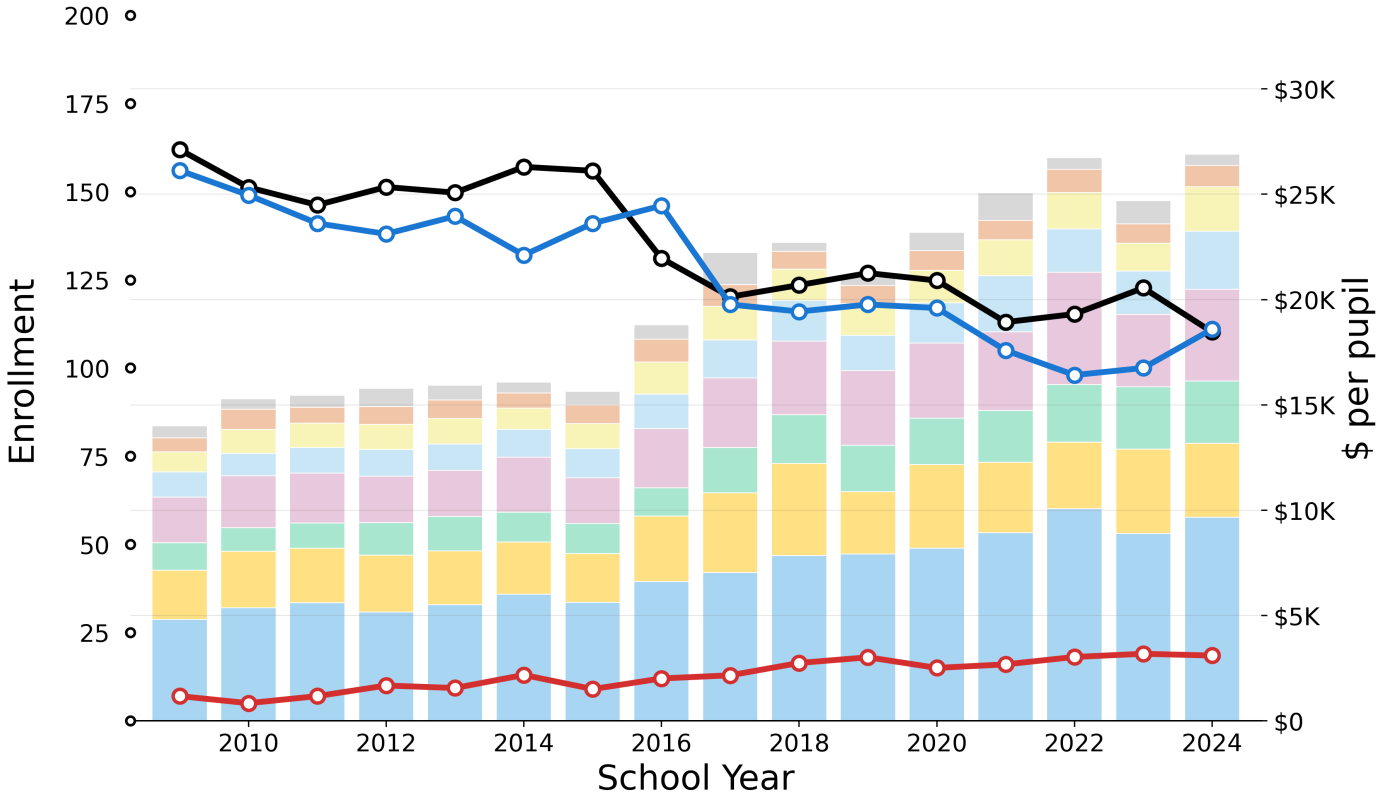

Figure 29

Table 32

Category	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Other	$580	-0.4%	+0.6%	+7.2%	$545
Administration	$652	+3.0%	+3.4%	+3.5%	$1,015
Instructional Leadership	$969	+5.3%	+7.7%	+6.8%	$2,103
Operations and Maintenance	$1,180	+5.8%	+7.5%	+10.6%	$2,754
Other Teaching Services	$2,185	+4.7%	+5.3%	+4.2%	$4,359
Pupil Services	$1,292	+5.7%	+7.6%	+6.1%	$2,962
Insurance, Retirement and Other	$2,332	+2.7%	+3.5%	+3.3%	$3,501
Teachers	$4,821	+4.7%	+4.9%	+4.1%	$9,669
Total	$14,011	+4.4%	+5.3%	+5.0%	$26,908

Table 33

Enrollment	2009	CAGR 15y	CAGR 10y	CAGR 5y	2024
In-District FTE Pupils	162	-2.5%	-3.5%	-2.8%	110
Foundation Enrollment	156	-2.2%	-1.7%	-1.2%	111
Out-of-District FTE Pupils	7	+6.7%	+3.6%	+0.5%	18

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔEnrollment| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

CAGR = (End/Start)^(1/years) – 1

Above cohort baseline (Tiny (0-200))

Below cohort baseline (Tiny (0-200))

Section 3 — Selected districts

Shutesbury — Chapter 70 Aid and Net School Spending (NSS)

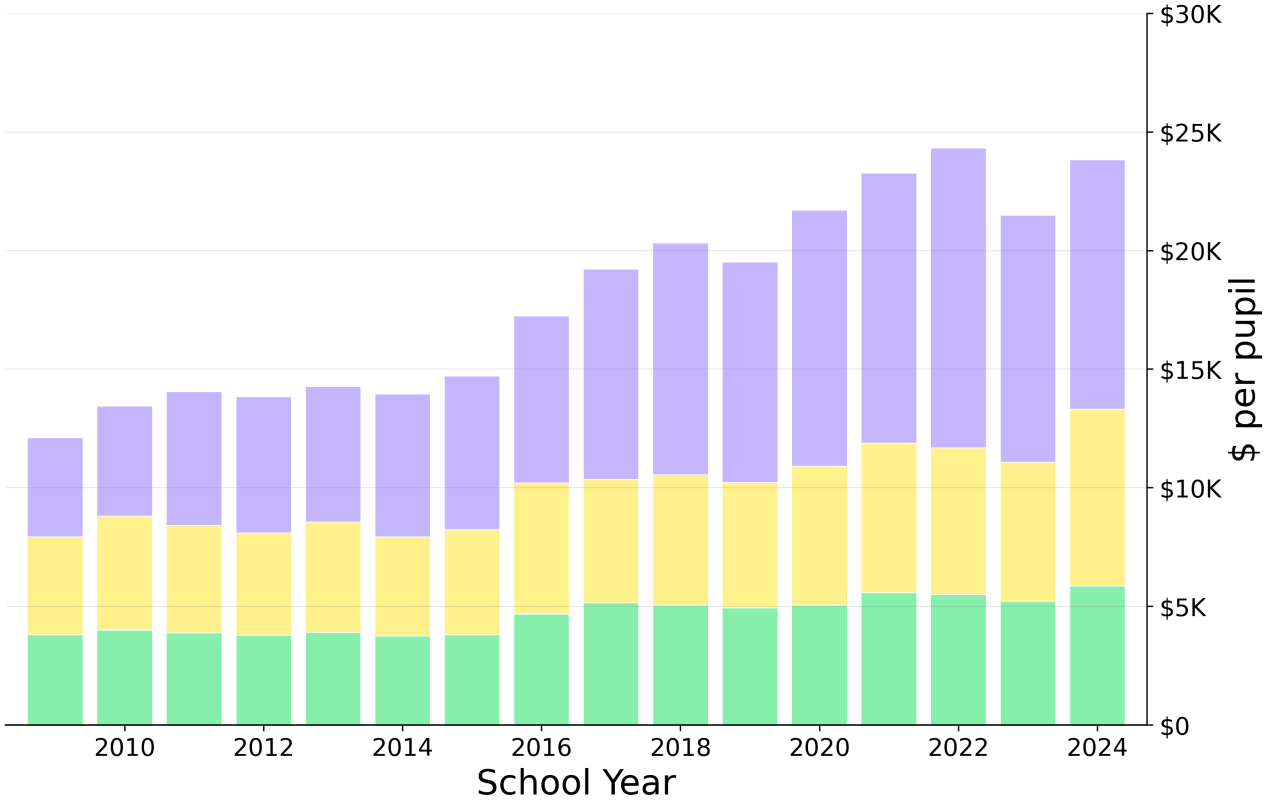

Figure 30

Table 34

Component	2009 $/pupil	CAGR 15y	CAGR 10y	CAGR 5y	2024 $/pupil
Actual NSS (minus Req NSS)	$4,173	6.36%	5.74%	2.51%	$10,526
Req NSS (minus Ch70)	$4,124	4.02%	5.92%	7.14%	$7,445
Ch70 Aid	$3,808	2.92%	4.58%	3.48%	$5,862
Total (Actual NSS)	$12,105	4.62%	5.50%	4.08%	$23,833

Shading vs baseline: |Δ$/pupil| ≥ 5.0%, |ΔCAGR| ≥ 1.0pp

Above cohort baseline (Tiny (0-200))

CAGR = (End/Start)^(1/years) – 1

Below cohort baseline (Tiny (0-200))

Appendix A. Data Sources & Calculation Methodology

1. Data Sources

District Expenditures by Spending Category: Source: Massachusetts Department of Elementary and Secondary Education (DESE) Last updated: August 12, 2025 URL: https://educationtocareer.data.mass.gov/Finance-and-Budget/District-Expenditures-by-Spending-Category/er3w-dyti/

This dataset provides detailed expenditure data by category for all Massachusetts school districts, including: • Expenditures per pupil (EPP) by spending category • Student enrollment (In-District FTE, Out-of-District FTE, Total FTE) • Annual data from FY1993 to present

Chapter 70 District Profiles: Source: Massachusetts Department of Elementary and Secondary Education (DESE) URL: Various sources compiled in profile_DataC70 spreadsheet tab

From the Ch70 website: "Chapter 70 District Profiles: The on-line Chapter 70 database shows, for each school district, yearly spending and state aid totals in comparison to the foundation budget. Trend data is available for each year going back to FY1993."

This dataset provides: • Chapter 70 Aid (c70aid): State aid received by each district • Required Net School Spending (rqdnss2): Minimum spending required by state law • Actual Net School Spending (actualNSS): Total district spending on education • Foundation Enrollment (distfoundenro): District foundation enrollment used for Ch70 funding calculations

Regional Classifications: Source: DESE district profiles and regional service mappings • Districts classified as Western MA based on EOHHS regional designations • School type classifications (Traditional, Regional, Charter, etc.)

2. Per-Pupil Expenditure (PPE) Definition

Per-pupil expenditure (PPE) is reported in the End of Year Report (EOYR) for municipal and regional districts, and is calculated by in-district FTE.

Per the DESE's Researcher's Guide, section XV. Using financial data: *"The out-of-district total cannot be properly reported as a per-pupil expenditure because the cost of tuitions varies greatly depending on the reason for going out of district."*

3. Compound Annual Growth Rate (CAGR)

CAGR measures the mean annual growth rate over a specified time period, assuming constant growth.

Formula: CAGR = (End_Value / Start_Value)^(1 / Years) – 1

Example: If expenditures grow from $10,000 to $12,000 over 5 years: CAGR = ($12,000 / $10,000)^(1/5) – 1 = 1.2^0.2 – 1 = 0.0371 = 3.71% per year

Note: CAGR requires positive values at both endpoints and is undefined if data is missing.

3a. Year-over-Year (YoY) Growth Rate

YoY growth rate measures the percentage change from one year to the next, providing insight into annual fluctuations.

Formula: YoY Growth = (Value_year / Value_previous_year – 1) × 100

Example: If expenditures increase from $10,000 (Year 1) to $10,500 (Year 2): YoY Growth = ($10,500 / $10,000 – 1) × 100 = 5.0%

If expenditures then increase to $11,000 (Year 3): YoY Growth = ($11,000 / $10,500 – 1) × 100 = 4.76%

Key differences from CAGR: • YoY shows year-to-year changes; CAGR smooths growth over multiple years • YoY captures annual volatility; CAGR assumes constant growth • YoY is useful for identifying specific years with unusual growth patterns

4. Enrollment-Based Cohorts

Districts are grouped by total in-district FTE enrollment into five cohorts (based on IQR analysis) for meaningful peer comparison:

Tiny (0-200 FTE): 17 districts (Cohort 1: below Q1) **Member districts:** conway, erving, farmington river reg, florida, hancock, hawlemont, leverett, new salem-wendell, pelham, petersham, richmond, rowe, savoy, shutesbury, sunderland, and 2 others

Small (201-800 FTE): 13 districts (Cohort 2: Q1 to median) **Member districts:** clarksburg, deerfield, frontier, gateway, granby, hadley, hatfield, lee, lenox, orange, pioneer valley, ralph c mahar, southern berkshire

Medium (801-1600 FTE): 15 districts (Cohort 3: median to Q3) **Member districts:** amherst, amherst-pelham, berkshire hills, central berkshire, easthampton, gill-montague, greenfield, hoosac valley regional, mohawk trail, monson, mount greylock, north adams, palmer, southwick-tolland-granville regional school district, ware

Large (1601-10K FTE): 14 districts (Cohort 4: above Q3) **Member districts:** agawam, athol-royalston, belchertown, chicopee, east longmeadow, hampden-wilbraham, holyoke, longmeadow, ludlow, northampton, pittsfield, south hadley, west springfield,

westfield

Outliers (Springfield >10K FTE): 1 district (Cohort 5: statistical outlier, analyzed separately) **Member districts:** springfield

Weighted EPP Formula (for aggregate calculations): For each category and year: Weighted_EPP = Σ(District_EPP × District_In-District_FTE) / Σ(District_In-District_FTE)

Example: District A spends $5,000/pupil (500 students), District B spends $6,000/pupil (300 students) Weighted average = ($5,000×500 + $6,000×300) / (500+300) = $5,375/pupil

Enrollment Calculation: For each series (In-District FTE, Out-of-District FTE) and year: Sum across all member districts in the enrollment group.

Appendix A. Data Sources & Calculation Methodology (continued)

5. Orange/Blue Shading Logic (District Comparison Tables)

District pages include tables comparing each district's per-pupil expenditures (PPE) and growth rates (CAGR) to their enrollment-based peer group aggregate (Tiny, Small, Medium, Large, or Springfield).

Two independent tests determine shading:

Test 1 - Dollar Amount (2024 $/pupil column): Compares the district's 2024 PPE to the baseline's 2024 PPE using relative difference: (District − Baseline) / Baseline • **Orange shading:** District spending is ≥5.0% higher than baseline • **Blue shading:** District spending is ≥5.0% lower than baseline • **No shading:** Difference is less than 5.0%

Test 2 - CAGR (5y, 10y, 15y columns): Compares the district's CAGR to the baseline's CAGR using absolute percentage point difference: District_CAGR − Baseline_CAGR • **Orange shading:** District CAGR is ≥1.0 percentage points higher than baseline • **Blue shading:** District CAGR is ≥1.0 percentage points lower than baseline • **No shading:** Difference is less than 1.0 percentage points

Shading Intensity: Both metrics use graduated shading where darker colors indicate larger differences: • PPE/Enrollment bins: 5% (lightest), 10%, 15%, 20%+ (darkest) • CAGR bins: 1pp (lightest), 2pp, 3pp, 4pp+ (darkest)

Key insight: The tests are independent. An orange 2024 $/pupil with unshaded CAGRs typically means: • The district started at a higher baseline 15 years ago, AND • The district has been growing at roughly the same rate as peers • Therefore it remains higher in absolute dollars but isn't growing faster

Statistical Rationale: The 5%/1pp thresholds were selected through analysis of variation across all Western MA districts. See the Threshold Analysis page for detailed methodology and alternative scenarios considered.

Appendix A. Data Sources & Calculation Methodology (continued)

6. Chapter 70 Aid and Net School Spending (NSS) Calculations

Chapter 70 is Massachusetts' primary state aid program for K-12 education. Net School Spending (NSS) is the total amount a district spends on education from local and state sources.

Data Sources: • **Chapter 70 Aid (c70aid):** State aid received by the district (DESE profile_DataC70 sheet) • **Required NSS (rqdnss2):** Minimum spending required by state law, adjusted (DESE profile_DataC70 sheet) • **Actual NSS (actualNSS):** Total district spending on education (DESE profile_DataC70 sheet)

Important Note: NSS/Ch70 values are reported in **dollars per pupil**, consistent with PPE reporting. All absolute dollar amounts are divided by in-district FTE enrollment to produce per-pupil values.

Stacked Components (bottom to top in plots): 1. **Ch70 Aid ($/pupil):** c70aid / enrollment • Green bar in plots • State funding received per pupil

2. **Req NSS (adj) ($/pupil):** max(0, rqdnss2 – c70aid) / enrollment • Amber bar in plots • Required local contribution per pupil (after subtracting Ch70) • Uses max(0, ...) to handle rare cases where Ch70 > Required NSS

3. **Actual NSS (adj) ($/pupil):** (actualNSS – rqdnss2) / enrollment • Purple bar in plots • Spending above minimum requirement per pupil • Represents discretionary local spending beyond state mandates

Total NSS ($/pupil): Sum of all three components = actualNSS / enrollment

Example Calculation (Amherst, FY2024): Enrollment: 1,721 in-district FTE • Ch70 Aid: $6,791,000 / 1,721 = $3,946/pupil • Req NSS (adj): ($18,859,000 – $6,791,000) / 1,721 = $7,014/pupil • Actual NSS (adj): ($31,511,000 – $18,859,000) / 1,721 = $7,353/pupil • Total NSS: $3,946 + $7,014 + $7,353 = $18,313/pupil

Aggregate Calculation (Weighted Per-Pupil Average): For aggregate enrollment groups (Tiny, Small, Medium, Large, Springfield): 1. Convert each district's absolute dollars to per-pupil values 2. Compute enrollment-weighted average per-pupil across all member districts

This methodology produces per-pupil values that are weighted by enrollment size, enabling fair comparison across different-sized district aggregates.

Important: Only districts with valid PPE (per-pupil expenditure) data are included in NSS/Ch70 aggregates to ensure data quality and consistency across all analyses.

Shading: NSS/Ch70 comparison tables use the same orange/blue shading logic as PPE tables (5% dollar threshold, 1pp CAGR threshold).

Appendix A. Data Sources & Calculation Methodology (continued)

Rationale for 5% / 1pp Shading Thresholds

Table 35

Scenario	PPE/ Enrollment	CAGR	PPE Sensitivity	CAGR Sensitivity	Balance Ratio	Assessment
Previous (2%/2pp)	2.0%	2.00pp	0.09 SD	0.62 SD	6.97x	Unbalanced
Equal SD (5%/0.72pp)	5.0%	0.72pp	0.22 SD	0.22 SD	1.00x	Too tight for CAGR
Selected (5%/1pp)	5.0%	1.00pp	0.22 SD	0.31 SD	1.41x	Well-balanced
Proportional (5%/5pp)	5.0%	5.00pp	0.22 SD	1.55 SD	6.97x	CAGR too loose

Rationale for 5% / 1pp Shading Thresholds

Problem Statement: Different metrics have different natural variation. Using a uniform threshold (e.g., 2% for everything) creates unbalanced sensitivity where some comparisons over-flag minor differences while others under-flag meaningful ones.

Data Analysis: Examining all 59 Western MA traditional districts:

• **PPE variation:** Mean = $24,237, SD = $5,462, CV = 0.225 (22.5% typical variation)

• **CAGR variation:** Mean = 6.00pp, SD = 3.24pp, CV = 0.540 (54% typical variation)

• **Key insight:** CAGR naturally varies 2.4x more than PPE relative to their means

Methodology:

1. Calculated how many standard deviations each threshold represents

2. Compared 'sensitivity' (how strict each threshold is relative to typical variation)

3. Tested scenarios ranging from 2%/2pp (original) to 5%/5pp (proportional loosening)

4. Selected thresholds that balance statistical rigor with practical communication

Scenario Comparison:

• **Previous (2% / 2pp):** PPE=0.09 SD, CAGR=0.62 SD → CAGR 7x more sensitive (unbalanced)

• **Equal SD (5% / 0.72pp):** Both=0.22 SD → Perfect balance but 0.72pp too precise to communicate

• **Selected (5% / 1pp):** PPE=0.22 SD, CAGR=0.31 SD → 1.4x ratio (well-balanced, simple numbers)

• **Proportional (5% / 5pp):** PPE=0.22 SD, CAGR=1.55 SD → CAGR 7x looser (under-flags growth differences)

Selected Thresholds (5% / 1pp):

• **5% for PPE and enrollment:** Flags differences >= $1,212 (at mean), or ~1/5 of typical variation

• **1pp for CAGR:** Flags growth rate differences >= 1pp, or ~1/3 of typical variation

• **Balance ratio:** 1.4x (CAGR slightly more sensitive, recognizing higher natural variation)

• **Flagging rates:** ~82% for PPE, ~76% for CAGR (similar selectivity)

Design Philosophy: Why ~80% Flagging Rates Work with Gradient Shading

With **gradient shading** (not binary on/off), having ~80% of comparisons show some level of shading is actually ideal. The threshold acts as a **noise floor** that filters trivial differences while the graduated intensity creates three distinct levels of information:

• **No shading (white background):** Districts are statistically similar to their cohort (differences <5% / <1pp)

• **Light shading (subtle color):** Notable differences worth attention but not alarming

• **Intense shading (saturated color):** Exceptional outliers that immediately grab the eye

This creates a natural visual hierarchy where readers' eyes are drawn to the most intense colors (true outliers) while still being able to see the full pattern of variation across the lighter-shaded cells. The threshold filters out noise while the gradient intensity tells you *how much* a district differs from its peers.

The Goldilocks Solution (5% / 1pp):

This threshold pair hits the sweet spot across multiple dimensions:

Statistical balance:

• Similar flagging rates (~82% vs ~76%) despite very different natural variation (CV = 22.5% vs 54%)

• Proportional to underlying variation - neither metric dominates the visual attention

Practical communication:

• Round, memorable numbers (5% and 1pp)

• Easy to explain: "We flag 5% differences in dollars/enrollment, 1 percentage point differences in growth rates"

• Contrast with alternatives: 0.72pp would be statistically perfect but impractically precise to communicate

Appropriate sensitivity:

• Loosens overly-tight previous thresholds (2%/2pp had 93% PPE flagging)

• Filters trivial noise while capturing meaningful differences

• Reserves intense shading for truly exceptional cases

Shading Intensity: Both metrics use graduated shading with darker colors for larger differences:

• PPE/Enrollment: 5% (lightest), 10%, 15%, 20%+ (darkest)

• CAGR: 1pp (lightest), 2pp, 3pp, 4pp+ (darkest)

Note: These thresholds apply to all comparison tables throughout this report. They represent a balance between highlighting meaningful differences and avoiding excessive flagging of normal variation.

Appendix B. Calculations and Examples

Complete calculations and worked examples for all figures and tables

Purpose

This appendix provides calculations and worked examples for all figures and tables in the report. It combines step-by-step calculation procedures with detailed examples for verification.

==========

Figure 1: Year-over-Year (YoY) Growth Rates

Location: Executive Summary page

Source: executive_summary_plots.py, lines 44-63

Formula:

YoY Growth(year) = [(PPE(year) / PPE(year-1)) - 1] × 100

Calculation Steps:

1. For each district, get total PPE by year:

- Load expenditure data from df (all expense categories)

- Pivot to get PPE by category and year

- Sum across all categories: total_ppe[year] = sum(PPE_category[year] for all categories)

2. Calculate YoY growth:

- For year in [2010, 2011, ..., 2024]:

YoY[year] = [(total_ppe[year] / total_ppe[year-1]) - 1] × 100

- First year (2009) has no YoY value (no prior year)

3. For cohort aggregates:

- Get all districts in cohort

- Calculate weighted aggregate PPE (see Calculation #5)

- Apply same YoY formula to aggregate PPE series

Example (Amherst 2023-2024):

- PPE(2023) = $25,432.18

- PPE(2024) = $26,789.45

- YoY Growth = [(26,789.45 / 25,432.18) - 1] × 100 = 5.34%

==========

Figure 2: 5-Year CAGR (Compound Annual Growth Rate) - Grouped Bars

Location: Executive Summary page

Source: executive_summary_plots.py, lines 66-95

Formula:

CAGR = [(End_Value / Start_Value)^(1/Years) - 1] × 100

Calculation Steps:

1. Define three 5-year periods:

- Period 1: 2009-2014 (5 years)

- Period 2: 2014-2019 (5 years)

- Period 3: 2019-2024 (5 years)

2. For each district and each period:

- Get total_ppe[start_year] and total_ppe[end_year]

- CAGR = [(total_ppe[end] / total_ppe[start])^(1/5) - 1] × 100

3. For cohort aggregates:

- Use weighted aggregate PPE (see Calculation #5)

- Apply same CAGR formula

Example (Medium Cohort 2019-2024):

- Weighted PPE(2019) = $22,145.67

- Weighted PPE(2024) = $28,934.21

- CAGR = [(28,934.21 / 22,145.67)^(1/5) - 1] × 100

- CAGR = [1.30672^0.2 - 1] × 100

- CAGR = [1.05497 - 1] × 100 = 5.50%

==========

Figure 3: 15-Year CAGR (2009-2024)

Location: Executive Summary page

Source: executive_summary_plots.py, lines 98-118

Formula:

CAGR_15yr = [(PPE(2024) / PPE(2009))^(1/15) - 1] × 100

Calculation Steps:

1. Get total_ppe[2009] and total_ppe[2024] for each district

2. Apply CAGR formula with years = 15

3. For cohort aggregates, use weighted aggregate PPE

Example (Amherst):

- PPE(2009) = $18,234.56

- PPE(2024) = $26,789.45

- CAGR = [(26,789.45 / 18,234.56)^(1/15) - 1] × 100

- CAGR = [1.46923^0.06667 - 1] × 100 = 2.61%

==========

2. COHORT DETERMINATION CALCULATIONS

Purpose: Assign each district to one of 6 enrollment-based cohorts

Source: school_shared.py, lines 140-200 (calculate_cohort_boundaries)

Cohort Definitions:

- TINY: 0 - Q1 (25th percentile)

- SMALL: Q1 - Q2 (median)

- MEDIUM: Q2 - Q3 (75th percentile)

- LARGE: Q3 - 10,000 FTE

- SPRINGFIELD: > 10,000 FTE (outlier district)

Calculation Steps (FY2024):

1. Get all Western MA traditional districts

2. Get FY2024 FTE enrollment for each district

3. Create array of all enrollments (INCLUDING Springfield):

all_enrollments = [154.7, 287.3, ..., 24,567.8] # 59 districts

4. Calculate percentiles ON FULL DATASET:

- Q1 (25th) = np.percentile(all_enrollments, 25) = 154.7

- Q2 (50th) = np.percentile(all_enrollments, 50) = 520.3

- Q3 (75th) = np.percentile(all_enrollments, 75) = 1,597.6

- P90 (90th) = np.percentile(all_enrollments, 90) = 3,892.1

5. Round to clean boundaries:

- Q1: 154.7 → 200 FTE

- Median: 520.3 → 500 FTE

- Q3: 1,597.6 → 1,600 FTE

- P90: 3,892.1 → 4,000 FTE

- Outlier threshold: Fixed at 10,000 FTE

6. Final FY2024 Cohort Boundaries:

- TINY: 0-200 FTE (13 districts)

- SMALL: 201-500 FTE (16 districts)

- MEDIUM: 501-1,600 FTE (15 districts)

- LARGE: 1,601-10,000 FTE (14 districts)

- SPRINGFIELD: >10,000 FTE (1 district: 24,567.8 FTE)

Note: For historical data, cohorts are calculated year-by-year using that year's enrollment distribution.

==========

3. WEIGHTED AGGREGATION METHODOLOGY

Purpose: Calculate enrollment-weighted per-pupil expenditure for a group of districts

Source: school_shared.py, lines 1001-1050 (weighted_epp_aggregation)

Formula:

Weighted PPE(category, year) = Σ[PPE(d, cat, yr) × FTE(d, yr)] / Σ[FTE(d, yr)]

where d = district, cat = category, yr = year

Calculation Steps:

1. For each district d in cohort:

- Get PPE by category and year: PPE(d, category, year)

- Get FTE enrollment by year: FTE(d, year)

2. For each category and year:

- Calculate weighted numerator:

numerator(cat, yr) = Σ[PPE(d, cat, yr) × FTE(d, yr)] for all d in cohort

- Calculate total FTE:

denominator(yr) = Σ[FTE(d, yr)] for all d in cohort

- Weighted PPE(cat, yr) = numerator(cat, yr) / denominator(yr)

Example (Medium Cohort, Instruction category, 2024):

Districts in Medium cohort (FY2024): 15 districts

District A: PPE_instruction = $12,345, FTE = 678

District B: PPE_instruction = $13,456, FTE = 891

...

District O: PPE_instruction = $11,234, FTE = 1,234

Numerator = (12,345 × 678) + (13,456 × 891) + ... + (11,234 × 1,234)

= 8,369,910 + 11,989,296 + ... + 13,862,756

= 156,432,890

Denominator = 678 + 891 + ... + 1,234 = 13,456 FTE

Weighted PPE_instruction = 156,432,890 / 13,456 = $11,627.45/pupil

==========

4. SHADING THRESHOLD CALCULATIONS

Purpose: Determine 5% / 1pp thresholds for gradient shading in comparison tables

Source: Appendix A (Threshold Analysis), compose_pdf.py lines 1212-1349

Statistical Analysis (All 59 Western MA Districts):

1. Calculate variation in PPE:

- Mean PPE = $24,237

- Std Dev PPE = $5,462

- Coefficient of Variation (CV) = 5,462 / 24,237 = 0.225 (22.5%)

2. Calculate variation in CAGR:

- Mean CAGR = 6.00 percentage points

- Std Dev CAGR = 3.24 percentage points

- Coefficient of Variation (CV) = 3.24 / 6.00 = 0.540 (54.0%)

3. Key insight: CAGR varies 2.4× more than PPE relative to means (54.0% / 22.5% = 2.4)

4. Evaluate threshold scenarios:

Scenario: 5% PPE / 1pp CAGR (SELECTED)

- PPE: 5% = 0.05 × 24,237 = $1,212

- PPE Standard Deviations: 1,212 / 5,462 = 0.22 SD

- CAGR Standard Deviations: 1.00 / 3.24 = 0.31 SD

- Balance ratio: 0.31 / 0.22 = 1.4× (well-balanced)

- PPE flagging rate: ~82% of comparisons

- CAGR flagging rate: ~76% of comparisons

Gradient Shading Bins:

- CAGR bins (absolute percentage points): [1pp, 2pp, 3pp, 4pp+]

- Dollar bins (relative percent): [5%, 10%, 15%, 20%+]

- Intensity increases with bin: lightest shade → darkest shade

==========

5. DISTRICT COMPARISON TABLE CALCULATIONS

Purpose: Compare district PPE to baseline (cohort or Western MA aggregate)

Source: compose_pdf.py, lines 425-583 (_build_category_table)

For Each Category (e.g., Instruction, Student Support, etc.):

1. Get latest year (2024) and 5-year-ago baseline (2019)

2. Calculate CAGR:

District CAGR = [(PPE_2024 / PPE_2019)^(1/5) - 1] × 100

Baseline CAGR = [(Baseline_PPE_2024 / Baseline_PPE_2019)^(1/5) - 1] × 100

3. Calculate CAGR difference (absolute percentage points):

CAGR_diff = |District_CAGR - Baseline_CAGR|

4. Determine CAGR shading:

if CAGR_diff < 1.0pp: No shading (white)

elif CAGR_diff < 2.0pp: Lightest shade

elif CAGR_diff < 3.0pp: Light shade

elif CAGR_diff < 4.0pp: Medium shade

else: Darkest shade

Color: Amber if above baseline, Teal if below

5. Calculate dollar difference (relative percent):

Dollar_diff = |PPE_2024 - Baseline_PPE_2024| / Baseline_PPE_2024

6. Determine dollar shading:

if Dollar_diff < 5%: No shading

elif Dollar_diff < 10%: Lightest shade

elif Dollar_diff < 15%: Light shade

elif Dollar_diff < 20%: Medium shade

else: Darkest shade

Color: Amber if above baseline, Teal if below

Example (Amherst Instruction vs Medium Cohort):

- Amherst PPE_2019 = $10,234, PPE_2024 = $12,456

- Medium PPE_2019 = $9,876, PPE_2024 = $11,234

CAGR calculations:

- Amherst CAGR = [(12,456 / 10,234)^0.2 - 1] × 100 = 4.01%

- Medium CAGR = [(11,234 / 9,876)^0.2 - 1] × 100 = 2.60%

- CAGR_diff = |4.01 - 2.60| = 1.41pp → Light amber shade

Dollar calculations:

- Dollar_diff = |12,456 - 11,234| / 11,234 = 10.88%

- 10.88% is in [10%, 15%) range → Light amber shade

==========

6. ENROLLMENT FTE CALCULATIONS

Purpose: Calculate total FTE enrollment from component categories

Source: school_shared.py, prepare_district_epp_lines()

FTE Categories:

- Foundation Enrollment (low-income, ELL, special ed weighted)

- PK (Pre-Kindergarten)

- K-6 (Kindergarten through 6th grade)

- 7-12 (7th through 12th grade)

Calculation:

Total FTE(year) = Foundation(year) + PK(year) + K6(year) + 712(year)

Example (Amherst 2024):

- Foundation = 1,234.5 FTE

- PK = 89.2 FTE

- K-6 = 678.3 FTE

- 7-12 = 543.1 FTE

- Total FTE = 1,234.5 + 89.2 + 678.3 + 543.1 = 2,545.1 FTE

==========

7. NSS/CH70 FUNDING CALCULATIONS

Purpose: Calculate Chapter 70 aid and Net School Spending from components

Source: school_shared.py, prepare_district_nss_ch70()

Components:

- Foundation Budget: State-determined minimum spending level

- Required Local Contribution: Municipality's required contribution

- Chapter 70 Aid: State aid = Foundation - Required Local Contribution

- Actual Net School Spending (NSS): Actual spending by district

Calculations:

Ch70 Aid = Foundation Budget - Required Local Contribution

NSS Gap = Actual NSS - Foundation Budget

Total Spending = Required Local Contribution + Ch70 Aid + NSS Gap

Example (Amherst 2024):

- Foundation Budget = $45,678,901

- Required Local Contribution = $38,234,567

- Ch70 Aid = $45,678,901 - $38,234,567 = $7,444,334

- Actual NSS = $52,123,456

- NSS Gap = $52,123,456 - $45,678,901 = $6,444,555

==========

NOTES

• All dollar values shown are illustrative examples for demonstration purposes

• Actual data values are stored in Appendix C (Data Tables)

• All calculations use enrollment-weighted aggregations for cohort comparisons

• CAGR calculations exclude negative or zero values

• Shading applies independently to CAGR and dollar comparisons

• Year-specific cohort assignments are used for all historical maps and scatterplots

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DETAILED WORKED EXAMPLES

The following sections provide complete worked examples for specific districts and cohorts:

This appendix provides calculation examples showing the source of numbers and demonstrating every step of the analysis for two examples:

1. Western MA Medium Cohort (aggregate cohort calculations)

2. Amherst-Pelham Regional (individual district calculations)

The following pages detail:

• Data sources and cohort determination methodology

• Weighted average per-pupil expenditure calculations

• Time series analysis and compound annual growth rate (CAGR) formulas

• Chapter 70 state aid and Net School Spending calculations

• Comparative analysis methods

PART 1: DATA SOURCES AND COHORT DETERMINATION

All calculations use data from the file "E2C_Hub_MA_DESE_Data.xlsx" which contains multiple sheets:

• Sheet "District Expend by Category": Contains expenditure and enrollment data with columns DIST_NAME, YEAR, IND_CAT, IND_SUBCAT, IND_VALUE, SOURCE

• Sheet "District Regions": Contains regional classifications and school types

• Sheet "profile_DataC70": Contains Chapter 70 and Net School Spending data

Data sources by sheet (per SOURCE column):

District Expend by Category - Expenditures per Pupil:

Source: Massachusetts Department of Elementary and Secondary Education (DESE)

Dataset: "District Expenditures by Spending Category"

Last updated: August 12, 2025

URL: https://educationtocareer.data.mass.gov/Finance-and-Budget/District-Expenditures-by-Spending-Category/er3w-dyti/

This dataset provides:

• Expenditures per pupil (EPP) by spending category for all Massachusetts school districts

• Annual data from FY1993 to present

• Eight spending categories: Teachers, Insurance/Retirement/Other, Pupil Services, Other Teaching Services, Operations and Maintenance, Instructional Leadership, Administration, Other

District Expend by Category - Student Enrollment:

Source: Massachusetts Department of Elementary and Secondary Education (DESE)

Dataset: "District Expenditures by Spending Category"

URL: https://educationtocareer.data.mass.gov/Finance-and-Budget/District-Expenditures-by-Spending-Category/er3w-dyti/

This dataset provides three enrollment indicators:

• In-District FTE Pupils: Students enrolled in district-operated schools (used for cohort calculations)

• Out-of-District FTE Pupils: District students placed in other schools

• Total FTE Pupils: Sum of In-District and Out-of-District FTE

profile_DataC70 - Chapter 70 and Net School Spending:

Source: Massachusetts Department of Elementary and Secondary Education (DESE)

Dataset: Chapter 70 District Profiles (compiled from various DESE sources)

URL: Various sources compiled in profile_DataC70 spreadsheet

This dataset provides:

• Chapter 70 Aid (c70aid): State aid received by each district

• Required Net School Spending (rqdnss2): Minimum spending required by state law

• Actual Net School Spending (actualNSS): Total district spending on education

• Foundation Enrollment (distfoundenro): District foundation enrollment used for Ch70 funding calculations

District Regions - Regional Classifications:

Source: DESE district profiles and regional service mappings

This dataset provides:

• EOHHS regional designations (Western MA, Central MA, etc.)

• School type classifications (Traditional, Regional, Charter, Virtual, etc.)

1.1 COHORT BOUNDARY DETERMINATION

Cohort boundaries are determined by reference to Interquartile Range (IQR) analysis on Fiscal Year 2024 Full-Time Equivalent (FTE) in-district enrollment for all traditional public school districts in Western Massachusetts. Cohort boundaries are rounded for easier readability.

Step 1: Extract FY24 In-district FTE enrollment data

From Sheet "District Expend by Category", filter rows where:

• IND_CAT = "Student Enrollment"

• IND_SUBCAT = "In-District FTE Pupils" (Full-Time Equivalent students enrolled in district-operated schools)

• YEAR = 2024

Step 2: Calculate quartile statistics

Using the 60 traditional districts in Western MA with valid data (including Springfield), calculate:

• First quartile (Q1) = 25th percentile = 154.7 In-district FTE

• Second quartile/Median (Q2) = 50th percentile = 792.0 In-district FTE

• Third quartile (Q3) = 75th percentile = 1,597.6 In-district FTE

• 90th percentile (P90) = 3,571.1 In-district FTE

Step 3: Define cohort boundaries

• TINY: 0 to 200 In-district FTE (from zero to Q1 rounded to nearest 100)

• SMALL: 201 to 800 In-district FTE (from max TINY +1 to Median rounded to nearest 100)

• MEDIUM: 801 to 1,600 In-district FTE (from max SMALL +1 to Q3 rounded to nearest 100)

• LARGE: 1,601 to 4,000 In-district FTE (from max MEDIUM +1 to P90 rounded to nearest 1,000)

• X-LARGE: 4,001 to 10K In-district FTE (from max LARGE +1 to fixed threshold of 10,000)

• OUTLIERS (Springfield): Greater than fixed threshold of 10,000 In-district FTE

Step 4: Assign each district to its cohort

For each district, compare its FY24 In-district FTE enrollment to the boundaries above.

Example: Amherst-Pelham Regional has 1,209.3 In-district FTE in FY24

Since 801 ≤ 1,209.3 ≤ 1,600, Amherst-Pelham is assigned to the MEDIUM cohort.

Example: Gill-Montague Regional has 899.8 In-district FTE in FY24

Since 801 ≤ 899.8 ≤ 1,600, Gill-Montague is assigned to the MEDIUM cohort.

Example: Belchertown has 2,067.8 In-district FTE in FY24

Since 1,601 ≤ 2,067.8 ≤ 4,000, Belchertown is assigned to the LARGE cohort.

1.2 EXPENDITURE CATEGORIES

All Per-Pupil Expenditure (PPE) calculations use eight categories:

1. Teachers
2. Insurance, Retirement and Other
3. Pupil Services
4. Other Teaching Services
5. Operations and Maintenance
6. Instructional Leadership
7. Administration
8. Other

These categories are derived from the Massachusetts Department of Elementary and Secondary Education (DESE) function code groupings in end-of-year reporting, and provide a standardized breakdown of all district expenditures. Note: District budgeting practices typically use categories that do not match the DESE end-of-year reporting standard.

PART 2: WESTERN MA MEDIUM COHORT CALCULATIONS

The Medium cohort contains 15 districts with in-district enrollment between 801 and 1,600 FTE in FY24. This section demonstrates how weighted average Per-Pupil Expenditure (PPE) is calculated for the cohort.

2.1 MEMBER DISTRICTS

Districts in the Medium cohort (sorted by FY24 In-district FTE enrollment):

1. Mohawk Trail: 804.8 In-district FTE
2. Monson: 807.8 In-district FTE
3. Gill-Montague: 899.8 In-district FTE
4. Amherst: 1,001.5 In-district FTE
5. Hoosac Valley Regional: 1,002.7 In-district FTE

6. Palmer: 1,061.5 In-district FTE

7. Ware: 1,095.8 In-district FTE

8. Berkshire Hills: 1,174.4 In-district FTE

9. North Adams: 1,196.0 In-district FTE

10. Mount Greylock: 1,206.9 In-district FTE

11. Amherst-Pelham: 1,209.3 In-district FTE

12. Southwick-Tolland-Granville Regional School District: 1,312.8 In-district FTE

13. Greenfield: 1,394.0 In-district FTE

14. Easthampton: 1,403.7 In-district FTE

15. Central Berkshire: 1,585.9 In-district FTE

Total In-district FTE for Medium cohort = Sum of all member In-district FTE = 17,156.9 FTE

2.2 WEIGHTED AVERAGE PPE CALCULATION (EXAMPLE: FY2024 TEACHERS)

For each expenditure category, we calculate an enrollment-weighted average across all districts in the cohort.

Step 1: Extract per-pupil expenditure data for Teachers category

From Sheet "District Expend by Category", filter rows where:

• IND_CAT = "Expenditures per Pupil"

• IND_SUBCAT = "Teachers"

• YEAR = 2024

Step 2: For each district, multiply PPE by enrollment weight

Example calculations for first three districts:

Mohawk Trail:

• FY24 Teachers PPE = [actual value from data] per pupil

• FY24 In-district FTE Enrollment = 804.8 FTE

• Weight = 804.8 / 17,156.9 = 0.0469 (4.69% of cohort enrollment)

• Weighted contribution = [Teachers PPE] × 0.0469

Monson:

• FY24 Teachers PPE = [actual value from data] per pupil

• FY24 In-district FTE Enrollment = 807.8 FTE

• Weight = 807.8 / 17,156.9 = 0.0471 (4.71% of cohort enrollment)

• Weighted contribution = [Teachers PPE] × 0.0471

Gill-Montague:

• FY24 Teachers PPE = [actual value from data] per pupil

• FY24 In-district FTE Enrollment = 899.8 FTE

• Weight = 899.8 / 17,156.9 = 0.0524 (5.24% of cohort enrollment)

• Weighted contribution = [Teachers PPE] × 0.0524

[Continue for all 15 districts...]

Step 3: Sum all weighted contributions

Weighted Average Teachers PPE = Sum of all weighted contributions = [calculated value] per pupil

This weighted average calculation is repeated for all eight categories:

1. Teachers
2. Insurance, Retirement and Other
3. Pupil Services
4. Other Teaching Services
5. Operations and Maintenance
6. Instructional Leadership
7. Administration
8. Other

Step 4: Calculate total weighted average PPE

Total Weighted Average PPE (FY24) = Sum of all eight category weighted averages

= Teachers + Insurance + Pupil Services + Other Teaching + Operations + Instructional Leadership + Administration + Other

= [sum of actual calculated values] per pupil

2.3 TIME SERIES CALCULATIONS

The same weighted average calculation is performed for each fiscal year from 2009 to 2024, producing a time series of cohort-level PPE values.

For each year Y from 2009 to 2024:

1. Extract FY Y enrollment for all 13 Medium cohort districts
2. Calculate cohort total enrollment for year Y
3. **For each of the 8 expenditure categories:**

a. Extract PPE values for year Y

b. Calculate enrollment weight for each district in year Y

c. Calculate weighted average PPE for that category in year Y

4. Sum the 8 category weighted averages to get total PPE for year Y

This produces arrays:

• Years: [2009, 2010, 2011, ..., 2024]

• Total PPE: [PPE_2009, PPE_2010, PPE_2011, ..., PPE_2024]

• Teachers PPE: [Teachers_2009, Teachers_2010, ..., Teachers_2024]

• [Similar arrays for other 7 categories]

2.4 COMPOUND ANNUAL GROWTH RATE (CAGR)

CAGR measures the annualized growth rate over multiple years.

Formula:

CAGR = ((Value_end / Value_start)^(1/number_of_years) - 1) × 100%

Where:

• Value_end = PPE in final year (2024)

• Value_start = PPE in initial year (2009)

• number_of_years = 2024 - 2009 = 15 years

Example for Medium cohort Total PPE:

• PPE_2009 = [calculated weighted average for 2009] per pupil

• PPE_2024 = [calculated weighted average for 2024] per pupil

• Number of years = 15

CAGR = ((PPE_2024 / PPE_2009)^(1/15) - 1) × 100%

= [calculated value] % per year

This calculation is performed for:

• Total PPE CAGR

• Each of the 8 category-specific PPE CAGRs

• Chapter 70 state aid CAGR

• Net School Spending (NSS) CAGR

• Enrollment CAGR

2.5 YEAR-OVER-YEAR (YOY) GROWTH RATE

Year-over-Year (YoY) growth rate measures the percentage change from one year to the next, providing insight into annual fluctuations in expenditures.

Formula:

YoY Growth Rate = ((Value_year / Value_previous_year) - 1) × 100%

Where:

• Value_year = PPE in current year

• Value_previous_year = PPE in previous year

Example for Medium cohort Total PPE:

Assume the time series shows:

• PPE_2009 = $12,000 per pupil

• PPE_2010 = $12,500 per pupil

• PPE_2011 = $13,000 per pupil

• PPE_2012 = $13,100 per pupil

• ...

YoY calculations:

• YoY_2010 = (($12,500 / $12,000) - 1) × 100% = 4.17%

• YoY_2011 = (($13,000 / $12,500) - 1) × 100% = 4.00%

• YoY_2012 = (($13,100 / $13,000) - 1) × 100% = 0.77%

• ...

Key differences from CAGR:

• YoY shows year-to-year changes; CAGR smooths growth over multiple years

• YoY captures annual volatility; CAGR assumes constant growth

• YoY is useful for identifying specific years with unusual growth patterns

Example comparison:

If CAGR from 2009 to 2024 is 3.71% per year, but YoY rates vary from 0.5% to 8.0% across individual years, this reveals that growth was not constant—some years had much higher or lower increases than the average.

Use cases:

• Identifying years with budget constraints (low YoY)

• Identifying years with significant increases (high YoY)

• Understanding the impact of specific events (e.g., pandemic, policy changes) on year-to-year spending

This YoY calculation is performed for:

• Total PPE YoY for each year from 2010 to 2024 (15 values)

• Each of the 8 category-specific PPE YoY rates

• Chapter 70 state aid YoY

• Net School Spending (NSS) YoY

• Enrollment YoY

Note: YoY for year N requires data from year N-1, so the first YoY value is for 2010 (comparing 2010 to 2009).

PART 3: AMHERST-PELHAM REGIONAL DISTRICT CALCULATIONS

This section demonstrates all calculations for a single district: Amherst-Pelham Regional.

3.1 DISTRICT PROFILE

District: Amherst-Pelham Regional

Cohort Assignment: MEDIUM (801-1,600 In-district FTE)

FY24 In-district FTE Enrollment: 1,209.3 FTE

Data Source: Appendix A Data Tables

• Enrollment data: See "In-District FTE" column in Appendix A

• PPE data: See expenditure category columns in Appendix A

• Chapter 70 data: See "Chapter 70 Aid" column in Appendix A

• NSS data: See "Required NSS" and "Actual NSS" columns in Appendix A

3.2 ENROLLMENT TIME SERIES

Step 1: Extract in-district enrollment data

From Appendix A Data Tables, locate:

• District: "Amherst-Pelham Regional"

• Find the "In-District FTE" column

• Read values for all years from 2009 to 2024

Step 2: Create time series array

Years: [2009, 2010, 2011, ..., 2023, 2024]

In-district FTE: [FTE_2009, FTE_2010, FTE_2011, ..., FTE_2023, 1,209.3]

(Extract actual values for each year from Appendix A)

Step 3: Calculate enrollment CAGR

CAGR = ((FTE_2024 / FTE_2009)^(1/15) - 1) × 100%

= ((1,209.3 / FTE_2009)^(1/15) - 1) × 100%

= [calculated value] % per year

Where:

• FTE_2024 = 1,209.3 In-district FTE (from data)

• FTE_2009 = [actual value from data] In-district FTE

• Number of years = 15 (2024 - 2009)

A negative CAGR indicates declining enrollment, positive indicates growth.

3.3 PER-PUPIL EXPENDITURE CALCULATIONS

For Amherst-Pelham Regional, PPE is calculated for each of the eight categories:

1. Teachers
2. Insurance, Retirement and Other
3. Pupil Services
4. Other Teaching Services
5. Operations and Maintenance
6. Instructional Leadership
7. Administration
8. Other

Step 1: Extract PPE data for each category

From Appendix A Data Tables, locate:

• District: "Amherst-Pelham Regional"

• Find the columns for each of the 8 expenditure categories

• Read values for all years from 2009 to 2024

Step 2: Example calculation for Teachers category (FY2024)

From Appendix A Data Tables:

• District: "Amherst-Pelham Regional"

• Year: 2024

• Column: "Teachers"

• Value: [actual value from Appendix A] per pupil

This value represents the amount Amherst-Pelham Regional spent per Full-Time Equivalent (FTE) student on Teachers in FY2024.

Step 3: Calculate total PPE for FY2024

Total PPE (FY2024) = Teachers + Insurance, Retirement and Other + Pupil Services + Other Teaching Services + Operations and Maintenance + Instructional Leadership + Administration + Other

Using column IND_VALUE for YEAR = 2024 and each category:

• Teachers: [actual value]

• Insurance, Retirement and Other: [actual value]

• Pupil Services: [actual value]

• Other Teaching Services: [actual value]

• Operations and Maintenance: [actual value]

• Instructional Leadership: [actual value]

• Administration: [actual value]

• Other: [actual value]

Total PPE (FY2024) = [sum of actual values] per pupil

Step 4: Repeat for all years 2009-2024

For each year from 2009 to 2024, extract IND_VALUE for each of the 8 categories and sum them to get total PPE for that year.

This produces time series arrays:

• Years: [2009, 2010, ..., 2024]

• Total PPE: [PPE_2009, PPE_2010, ..., PPE_2024]

• Teachers: [Teachers_2009, Teachers_2010, ..., Teachers_2024]

• Insurance, Retirement and Other: [Insurance_2009, Insurance_2010, ..., Insurance_2024]

• Pupil Services: [Pupil_Services_2009, Pupil_Services_2010, ..., Pupil_Services_2024]

• Other Teaching Services: [Other_Teaching_2009, Other_Teaching_2010, ..., Other_Teaching_2024]

• Operations and Maintenance: [Operations_2009, Operations_2010, ..., Operations_2024]

• Instructional Leadership: [Instructional_Leadership_2009, Instructional_Leadership_2010, ..., Instructional_Leadership_2024]

• Administration: [Administration_2009, Administration_2010, ..., Administration_2024]

• Other: [Other_2009, Other_2010, ..., Other_2024]

Step 5: Calculate CAGR for each category

Formula: CAGR = ((Value_2024 / Value_2009)^(1/15) - 1) × 100%

Example for Teachers:

• Teachers_2009 = [actual value from data] per pupil

• Teachers_2024 = [actual value from data] per pupil

• CAGR_Teachers = ((Teachers_2024 / Teachers_2009)^(1/15) - 1) × 100%

= [calculated value] % per year

Repeat this calculation for all 8 categories plus total PPE to get 9 CAGR values.

3.4 CHAPTER 70 STATE AID CALCULATIONS

Chapter 70 is the major state aid program for Massachusetts K-12 public schools.

Step 1: Extract Chapter 70 data

From Appendix A Data Tables, locate:

• District: "Amherst-Pelham Regional"

• Column: "Chapter 70 Aid"

• Read values for all years from 2009 to 2024

Step 2: Extract total district expenditures

From Appendix A Data Tables, calculate total expenditure as:

• District: "Amherst-Pelham Regional"

• Sum of all expenditure categories for each year

• Alternatively, use "Actual NSS" column if available

Step 3: Calculate Chapter 70 as percentage of total expenditure (FY2024 example)

• Chapter 70 Aid (FY2024) = [value from "Chapter 70 Aid" column in Appendix A for 2024]

• Total Expenditure (FY2024) = [sum of expenditure categories from Appendix A for 2024]

• Percentage = (Chapter 70 Aid / Total Expenditure) × 100%

This percentage shows what portion of the district's total expenditure came from Chapter 70 state aid in FY2024.

Step 4: Calculate Chapter 70 per-pupil (FY2024 example)

• Chapter 70 Aid (FY2024) = [value from "Chapter 70 Aid" column in Appendix A]

• Enrollment (FY2024) = 1,209.3 In-district FTE

• Chapter 70 Per-Pupil = Chapter 70 Aid / 1,209.3 FTE = [calculated value] per FTE

Step 5: Calculate Chapter 70 CAGR

• Chapter 70 Aid (2009) = [value from "Chapter 70 Aid" column in Appendix A for 2009]

• Chapter 70 Aid (2024) = [value from "Chapter 70 Aid" column in Appendix A for 2024]

• CAGR = ((Ch70Aid_2024 / Ch70Aid_2009)^(1/15) - 1) × 100%

= [calculated value] % per year

A negative CAGR indicates that Chapter 70 aid decreased, positive indicates growth.

3.5 NET SCHOOL SPENDING (NSS) CALCULATIONS

Net School Spending (NSS) is the total amount a school district spends on education from all sources, excluding certain items like transportation, debt service, and capital expenditures.

Step 1: Extract NSS data

From Appendix A Data Tables, locate:

• District: "Amherst-Pelham Regional"

• Columns: "Required NSS" and "Actual NSS"

• Read values for all years from 2009 to 2024

Step 2: Calculate NSS per-pupil (FY2024 example)

• Total NSS (FY2024) = [value from "Actual NSS" column in Appendix A for 2024]

• Enrollment (FY2024) = 1,209.3 In-district FTE

• NSS Per-Pupil = Total NSS / 1,209.3 FTE = [calculated value] per FTE

Step 3: Calculate NSS CAGR

• NSS (2009) = [value from "Actual NSS" column in Appendix A for 2009]

• NSS (2024) = [value from "Actual NSS" column in Appendix A for 2024]

• CAGR = ((NSS_2024 / NSS_2009)^(1/15) - 1) × 100%

= [calculated value] % per year

This indicates the average annual growth rate of NSS from 2009 to 2024.

Step 4: Compare NSS per-pupil to cohort average

Using the weighted average calculation method described in Part 2, the MEDIUM cohort average NSS per-pupil (FY2024) = [calculated weighted average] per FTE.

Amherst-Pelham's NSS per-pupil ([actual value from calculation]) is [percentage difference]% [above/below] the MEDIUM cohort average.

Calculation: ((Amherst-Pelham NSS per-pupil - MEDIUM cohort average) / MEDIUM cohort average) × 100%

3.6 COMPARATIVE ANALYSIS

All district-specific calculations can be compared to:

1. Cohort averages (in this case, MEDIUM cohort weighted averages for Amherst-Pelham Regional)

2. Regional averages (all Western MA traditional districts)

3. Statewide averages (if available)

For each metric (Total PPE, each of 8 category PPEs, Chapter 70 per-pupil, NSS per-pupil, enrollment growth), calculate:

• District value

• Cohort average

• Difference = District value - Cohort average

• Percentage difference = (Difference / Cohort average) × 100%

These comparisons reveal whether a district is spending more or less than similar-sized districts, and where specific spending differences occur across the eight categories:

1. Teachers

2. Insurance, Retirement and Other

3. Pupil Services

4. Other Teaching Services

5. Operations and Maintenance

6. Instructional Leadership

7. Administration

8. Other

Appendix C. Data Tables

All data values used in plots

This appendix contains the underlying data tables for all districts and regions shown in the report. Each table shows PPE by category (in $/pupil), FTE enrollment counts, and NSS/Ch70 funding components (in absolute dollars) across all available years.

Data: All Western MA Traditional Districts: Tiny (0-200 FTE)

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 36

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$577	$571	$623	$643	$647	$665	$676	$709	$780	$579	$673	$738	$1,380	$1,042	$1,304	$1,057
Administration	$770	$808	$814	$853	$915	$851	$774	$819	$863	$869	$770	$833	$950	$1,003	$1,114	$1,126
Instructional Leadership	$1,042	$1,096	$1,125	$1,225	$1,269	$1,316	$1,496	$1,584	$1,510	$1,524	$1,543	$1,589	$1,817	$1,733	$1,777	$1,991
Operations and Maintenance	$1,374	$1,312	$1,460	$1,416	$1,359	$1,558	$1,554	$1,452	$1,433	$1,468	$1,811	$1,670	$2,060	$2,389	$2,232	$2,652
Other Teaching Services	$1,899	$1,926	$1,987	$2,112	$2,412	$2,378	$2,494	$2,635	$2,673	$2,707	$3,004	$3,115	$3,322	$3,677	$3,638	$3,757
Pupil Services	$1,669	$1,792	$1,802	$1,899	$2,023	$2,061	$2,145	$2,206	$2,290	$2,261	$2,323	$2,204	$2,695	$2,673	$2,954	$3,406
Insurance, Retirement and Other	$2,258	$2,405	$2,595	$2,737	$2,926	$3,148	$3,125	$3,143	$3,905	$3,390	$3,662	$3,769	$4,357	$4,048	$4,506	$5,009
Teachers	$5,148	$5,382	$5,545	$5,277	$5,430	$5,906	$6,187	$6,222	$6,245	$6,520	$6,792	$6,982	$8,015	$7,858	$7,808	$8,507
Total	$14,738	$15,291	$15,950	$16,161	$16,981	$17,882	$18,452	$18,770	$19,700	$19,319	$20,577	$20,900	$24,596	$24,423	$25,334	$27,504

FTE Enrollment

Table 37

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	131	127	125	125	123	120	122	116	121	123	122	122	107	115	114	113
Foundation Enrollment	123	120	116	109	109	108	107	111	108	107	105	102	101	91	93	94
Out-of-District FTE Pupils	41	41	41	37	40	38	37	39	38	36	35	33	31	34	34	32

NSS/Ch70 Funding Components ($)

Table 38

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$3K	$3K	$3K	$3K	$3K	$3K	$3K	$4K	$4K	$4K	$4K	$4K	$4K	$4K	$4K	$5K
Req NSS (minus Ch70)	$5K	$6K	$6K	$6K	$7K	$7K	$7K	$7K	$7K	$7K	$7K	$7K	$8K	$7K	$8K	$8K
Actual NSS (minus Req NSS)	$5K	$4K	$5K	$5K	$5K	$6K	$6K	$6K	$8K	$7K	$8K	$8K	$10K	$10K	$10K	$10K
Total NSS	$13K	$14K	$15K	$15K	$15K	$16K	$16K	$17K	$18K	$18K	$19K	$19K	$22K	$21K	$22K	$23K

Data: All Western MA Traditional Districts: Small (201-800 FTE)

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 39

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$558	$505	$540	$533	$585	$515	$503	$583	$539	$596	$558	$512	$915	$777	$1,064	$1,150
Administration	$523	$515	$567	$601	$648	$665	$701	$739	$999	$752	$788	$802	$854	$942	$948	$976
Instructional Leadership	$811	$805	$838	$824	$909	$947	$967	$1,024	$1,028	$1,042	$1,016	$1,097	$1,188	$1,260	$1,336	$1,463
Operations and Maintenance	$1,108	$1,056	$1,043	$1,101	$1,198	$1,264	$1,295	$1,338	$1,254	$1,285	$1,473	$1,422	$1,676	$1,878	$2,176	$2,454
Other Teaching Services	$1,061	$1,089	$1,193	$1,151	$1,289	$1,311	$1,353	$1,446	$1,575	$1,718	$1,799	$1,806	$1,779	$1,899	$2,151	$2,402
Pupil Services	$1,813	$1,788	$1,859	$1,993	$2,216	$2,221	$2,216	$2,477	$2,438	$2,470	$2,643	$2,670	$2,903	$3,433	$3,656	$4,084
Insurance, Retirement and Other	$2,128	$2,107	$2,230	$2,317	$2,486	$2,568	$2,711	$2,955	$3,219	$3,345	$3,362	$3,420	$3,734	$3,801	$3,969	$4,254
Teachers	$4,522	$4,588	$4,679	$4,870	$5,353	$5,423	$5,557	$5,771	$6,026	$6,075	$6,152	$6,450	$6,922	$7,338	$7,596	$7,838
Total	$12,523	$12,453	$12,949	$13,388	$14,684	$14,916	$15,302	$16,333	$17,077	$17,283	$17,791	$18,177	$19,972	$21,330	$22,896	$24,622

FTE Enrollment

Table 40

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	775	779	763	742	696	680	661	644	628	614	617	601	560	556	553	542
Foundation Enrollment	695	676	666	646	628	603	590	559	542	536	528	526	522	494	484	481
Out-of-District FTE Pupils	75	78	73	73	80	82	86	82	85	88	90	88	85	87	87	84

NSS/Ch70 Funding Components ($)

Table 41

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$4K	$4K	$3K	$4K	$4K	$4K	$4K	$4K	$4K	$5K	$5K	$5K	$5K	$5K	$5K	$5K
Req NSS (minus Ch70)	$5K	$5K	$5K	$6K	$6K	$6K	$7K	$7K	$6K	$6K	$7K	$7K	$7K	$7K	$8K	$8K
Actual NSS (minus Req NSS)	$2K	$1K	$2K	$2K	$2K	$2K	$3K	$3K	$4K	$4K	$4K	$4K	$5K	$5K	$6K	$6K
Total NSS	$10K	$10K	$11K	$11K	$12K	$13K	$13K	$14K	$15K	$15K	$15K	$16K	$17K	$17K	$18K	$19K

Data: All Western MA Traditional Districts: Medium (801-1600 FTE)

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 42

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$461	$484	$558	$494	$561	$552	$524	$573	$586	$534	$644	$607	$930	$1,064	$1,055	$1,200
Administration	$494	$521	$512	$533	$575	$576	$614	$653	$678	$711	$653	$700	$747	$785	$835	$911
Instructional Leadership	$893	$902	$885	$1,039	$1,062	$1,091	$1,113	$1,169	$1,150	$1,071	$1,063	$1,113	$1,191	$1,263	$1,373	$1,573
Operations and Maintenance	$1,150	$1,085	$1,155	$1,095	$1,146	$1,208	$1,233	$1,218	$1,228	$1,203	$1,326	$1,383	$1,564	$1,663	$1,836	$1,953
Other Teaching Services	$1,014	$1,078	$1,100	$1,135	$1,235	$1,317	$1,362	$1,400	$1,444	$1,596	$1,681	$1,729	$1,936	$2,180	$2,311	$2,395
Pupil Services	$1,724	$1,693	$1,757	$1,763	$1,901	$1,984	$2,096	$2,184	$2,208	$2,406	$2,464	$2,403	$2,634	$2,967	$3,353	$3,581
Insurance, Retirement and Other	$2,483	$2,574	$2,743	$2,707	$2,707	$2,943	$3,074	$3,251	$3,266	$3,622	$3,631	$3,789	$4,169	$4,166	$4,480	$4,740
Teachers	$4,813	$4,890	$5,055	$5,048	$5,152	$5,357	$5,513	$5,578	$5,674	$5,960	$6,251	$6,385	$6,758	$6,773	$7,182	$7,431
Total	$13,032	$13,227	$13,766	$13,815	$14,340	$15,028	$15,529	$16,025	$16,234	$17,103	$17,713	$18,110	$19,930	$20,859	$22,426	$23,785

FTE Enrollment

Table 43

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	1,466	1,434	1,416	1,402	1,388	1,334	1,306	1,277	1,268	1,247	1,268	1,249	1,160	1,175	1,158	1,144
Foundation Enrollment	1,622	1,596	1,567	1,528	1,509	1,507	1,472	1,451	1,422	1,399	1,381	1,376	1,361	1,289	1,283	1,247
Out-of-District FTE Pupils	154	161	164	164	166	167	176	185	187	194	201	198	190	191	194	194

NSS/Ch70 Funding Components ($)

Table 44

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$6K	$6K	$5K	$6K	$6K	$6K	$6K	$7K	$7K	$7K	$7K	$7K	$8K	$8K	$9K	$9K
Req NSS (minus Ch70)	$4K	$5K	$5K	$5K	$6K	$6K	$6K	$6K	$6K	$6K	$7K	$7K	$8K	$8K	$8K	$9K
Actual NSS (minus Req NSS)	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$3K	$3K	$4K	$4K	$4K	$4K	$4K	$4K	$4K
Total NSS	$12K	$12K	$12K	$13K	$13K	$14K	$15K	$16K	$16K	$17K	$17K	$18K	$19K	$19K	$21K	$22K

Data: All Western MA Traditional Districts: Large (1601-10K FTE)

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 45

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$513	$648	$614	$611	$654	$631	$610	$644	$664	$667	$722	$716	$972	$1,075	$1,331	$1,348
Administration	$392	$415	$426	$437	$441	$462	$484	$496	$480	$494	$453	$502	$537	$571	$616	$649
Instructional Leadership	$811	$859	$865	$856	$837	$886	$915	$932	$956	$940	$998	$1,028	$1,060	$1,153	$1,195	$1,231
Operations and Maintenance	$1,014	$993	$1,009	$986	$984	$1,023	$1,093	$1,098	$1,111	$1,152	$1,244	$1,238	$1,401	$1,450	$1,685	$1,683
Other Teaching Services	$990	$1,037	$1,103	$1,105	$1,177	$1,228	$1,290	$1,365	$1,383	$1,395	$1,407	$1,429	$1,561	$1,717	$1,951	$2,021
Pupil Services	$1,531	$1,536	$1,622	$1,611	$1,697	$1,797	$1,849	$1,926	$1,948	$2,069	$2,171	$2,128	$2,200	$2,654	$2,955	$3,148
Insurance, Retirement and Other	$1,911	$1,943	$2,045	$2,123	$2,115	$2,282	$2,366	$2,419	$2,543	$2,652	$2,773	$2,855	$3,037	$3,212	$3,364	$3,469
Teachers	$4,613	$4,604	$4,707	$4,868	$4,990	$5,067	$5,194	$5,393	$5,482	$5,569	$5,863	$6,031	$6,461	$6,780	$7,001	$7,292
Total	$11,775	$12,034	$12,391	$12,597	$12,895	$13,376	$13,801	$14,273	$14,568	$14,937	$15,629	$15,927	$17,229	$18,612	$20,097	$20,841

FTE Enrollment

Table 46

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	4,001	3,953	3,935	3,852	3,812	3,760	3,721	3,674	3,690	3,680	3,616	3,598	3,397	3,422	3,384	3,379
Foundation Enrollment	4,432	4,382	4,347	4,325	4,280	4,230	4,191	4,163	4,093	4,077	4,037	4,013	3,975	3,823	3,787	3,752
Out-of-District FTE Pupils	215	227	244	253	256	272	293	309	316	322	341	345	344	341	354	357

NSS/Ch70 Funding Components ($)

Table 47

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$6K	$6K	$6K	$6K	$6K	$6K	$7K	$7K	$7K	$7K	$7K	$8K	$8K	$8K	$9K	$10K
Req NSS (minus Ch70)	$3K	$4K	$4K	$4K	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$6K	$6K	$6K	$6K
Actual NSS (minus Req NSS)	$934	$735	$932	$951	$991	$1K	$1K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$3K	$2K
Total NSS	$10K	$11K	$11K	$11K	$12K	$12K	$13K	$13K	$14K	$14K	$15K	$15K	$16K	$17K	$18K	$19K

Data: All Western MA Traditional Districts: Outliers (Springfield at 23,723 FTE in 2024)

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 48

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$1,143	$1,337	$2,068	$1,143	$1,424	$1,734	$1,241	$1,376	$1,286	$1,371	$1,673	$1,765	$2,487	$2,260	$2,923	$3,071
Administration	$533	$654	$446	$645	$550	$677	$596	$580	$507	$490	$416	$407	$441	$501	$599	$609
Instructional Leadership	$719	$778	$892	$1,173	$1,257	$1,245	$1,208	$1,282	$1,280	$1,060	$983	$1,090	$1,103	$1,402	$1,534	$1,571
Operations and Maintenance	$1,150	$1,081	$1,262	$1,176	$1,132	$997	$1,121	$1,027	$1,063	$1,156	$1,337	$1,093	$1,534	$1,536	$3,453	$3,806
Other Teaching Services	$1,143	$1,002	$1,146	$1,130	$1,051	$1,086	$1,150	$1,135	$1,070	$1,036	$1,357	$1,390	$1,337	$1,518	$1,776	$2,014
Pupil Services	$2,031	$1,873	$2,156	$2,353	$2,183	$2,257	$2,393	$2,467	$2,613	$2,845	$2,968	$2,631	$2,590	$3,602	$3,675	$3,901
Insurance, Retirement and Other	$2,050	$2,226	$2,280	$2,474	$2,437	$2,496	$2,467	$2,566	$2,562	$2,635	$2,765	$3,001	$3,217	$3,461	$3,852	$3,906
Teachers	$5,839	$4,859	$4,750	$4,711	$4,848	$4,823	$4,963	$5,196	$4,962	$5,274	$5,510	$5,800	$6,442	$7,095	$7,561	$7,737
Total	$14,608	$13,810	$15,000	$14,805	$14,882	$15,315	$15,139	$15,629	$15,343	$15,867	$17,009	$17,177	$19,151	$21,375	$25,373	$26,615

FTE Enrollment

Table 49

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	25,137	24,987	24,935	24,521	24,747	25,249	25,101	25,009	25,629	25,776	25,294	24,906	24,079	24,040	23,763	23,723
Foundation Enrollment	28,235	28,343	28,305	28,226	27,951	28,434	28,755	28,970	29,109	29,533	29,670	29,645	29,551	29,144	28,613	28,326
Out-of-District FTE Pupils	3,571	3,775	3,719	3,695	3,817	3,613	3,974	4,406	4,596	4,812	5,150	5,363	5,559	5,500	5,652	5,745

NSS/Ch70 Funding Components ($)

Table 50

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$10K	$10K	$11K	$11K	$12K	$12K	$12K	$12K	$12K	$13K	$14K	$15K	$16K	$17K	$18K	$20K
Req NSS (minus Ch70)	$278	$1K	$2K	$1K	$2K	$2K	$1K	$1K	$1K	$1K	$2K	$2K	$2K	$2K	$2K	$2K
Actual NSS (minus Req NSS)	$-169	$-435	$-40	$-97	$-163	$0	$2	$2	$-0	$-122	$-0	$-594	$0	$0	$-0	$-0
Total NSS	$11K	$11K	$12K	$13K	$13K	$13K	$13K	$14K	$14K	$14K	$15K	$16K	$18K	$19K	$20K	$22K

Data: Amherst-Pelham

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 51

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$646	$534	$900	$417	$459	$424	$599	$860	$635	$384	$610	$559	$477	$527	$457	$799
Administration	$652	$664	$687	$789	$987	$907	$953	$926	$996	$857	$759	$780	$788	$859	$928	$1,277
Instructional Leadership	$1,289	$1,337	$1,209	$1,397	$1,390	$1,545	$1,429	$1,437	$1,541	$1,555	$1,544	$1,501	$1,436	$1,472	$1,644	$2,336
Operations and Maintenance	$1,459	$1,416	$1,559	$1,468	$1,481	$1,585	$1,473	$1,577	$1,904	$1,678	$1,776	$1,601	$1,705	$1,778	$1,957	$2,221
Other Teaching Services	$1,199	$1,264	$1,313	$1,468	$1,588	$1,739	$1,770	$1,883	$2,014	$2,066	$2,122	$2,214	$3,010	$3,050	$2,968	$2,851
Pupil Services	$2,170	$2,196	$2,205	$2,302	$2,291	$2,497	$2,753	$2,908	$2,931	$3,109	$3,161	$2,902	$3,951	$3,780	$4,177	$4,231
Insurance, Retirement and Other	$3,305	$3,636	$3,673	$3,811	$3,526	$3,954	$4,086	$4,103	$4,218	$5,006	$5,047	$5,074	$5,237	$5,062	$5,887	$6,248
Teachers	$5,491	$5,511	$6,254	$6,199	$6,533	$6,765	$6,704	$6,590	$6,927	$7,208	$7,285	$7,155	$7,592	$7,404	$8,158	$8,270
Total	$16,211	$16,558	$17,800	$17,851	$18,255	$19,416	$19,767	$20,284	$21,166	$21,863	$22,304	$21,786	$24,196	$23,932	$26,176	$28,233

FTE Enrollment

Table 52

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	1,712	1,659	1,573	1,536	1,519	1,470	1,450	1,378	1,366	1,342	1,334	1,346	1,278	1,265	1,241	1,209
Foundation Enrollment	1,801	1,763	1,726	1,647	1,610	1,581	1,529	1,532	1,496	1,490	1,433	1,399	1,399	1,330	1,310	1,274
Out-of-District FTE Pupils	112	129	138	143	138	149	169	190	192	170	158	152	155	145	150	147

NSS/Ch70 Funding Components ($)

Table 53

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$6K	$6K	$6K	$6K	$6K	$6K	$6K	$7K	$7K	$7K	$7K	$7K	$7K	$8K	$8K	$8K
Req NSS (minus Ch70)	$5K	$7K	$7K	$7K	$7K	$8K	$8K	$8K	$8K	$9K	$9K	$9K	$10K	$10K	$11K	$11K
Actual NSS (minus Req NSS)	$4K	$2K	$3K	$4K	$4K	$4K	$5K	$5K	$5K	$6K	$6K	$6K	$5K	$5K	$6K	$6K
Total NSS	$14K	$15K	$16K	$17K	$18K	$18K	$19K	$20K	$21K	$21K	$22K	$22K	$23K	$23K	$24K	$26K

Data: Amherst

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 54

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$684	$547	$606	$931	$1,098	$1,098	$1,265	$1,242	$1,119	$798	$1,092	$733	$1,563	$1,561	$1,475	$1,328
Administration	$627	$698	$735	$709	$787	$809	$919	$944	$981	$799	$767	$827	$874	$896	$981	$1,213
Instructional Leadership	$1,134	$1,079	$965	$1,032	$1,153	$1,275	$1,175	$1,131	$1,087	$1,231	$1,325	$1,527	$1,750	$1,783	$1,847	$2,498
Operations and Maintenance	$1,264	$1,271	$1,636	$1,436	$1,399	$1,451	$1,577	$1,530	$1,555	$1,340	$1,646	$1,764	$1,897	$1,874	$1,941	$2,248
Other Teaching Services	$1,762	$1,813	$1,923	$2,345	$2,621	$2,610	$2,840	$2,652	$2,751	$2,973	$3,084	$3,053	$3,908	$3,898	$3,746	$4,612
Pupil Services	$1,261	$1,386	$1,335	$1,386	$1,553	$1,761	$1,802	$1,850	$1,818	$1,909	$2,030	$1,844	$2,035	$2,740	$2,821	$3,018
Insurance, Retirement and Other	$3,353	$3,610	$3,821	$3,852	$3,941	$4,189	$4,201	$4,295	$4,231	$4,840	$5,212	$5,363	$5,661	$5,561	$6,022	$6,605
Teachers	$5,944	$6,213	$6,355	$6,963	$6,804	$6,627	$6,841	$7,712	$7,792	$8,091	$8,538	$8,725	$9,528	$9,598	$9,451	$9,745
Total	$16,029	$16,617	$17,376	$18,654	$19,356	$19,820	$20,620	$21,356	$21,334	$21,981	$23,694	$23,836	$27,216	$27,911	$28,284	$31,267

FTE Enrollment

Table 55

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	1,387	1,331	1,284	1,215	1,196	1,197	1,184	1,154	1,156	1,163	1,131	1,107	1,017	1,052	1,062	1,002
Foundation Enrollment	1,398	1,405	1,356	1,279	1,269	1,227	1,205	1,192	1,199	1,136	1,106	1,134	1,097	1,045	1,065	1,055
Out-of-District FTE Pupils	65	72	73	84	90	90	101	113	110	108	124	122	118	123	129	134

NSS/Ch70 Funding Components ($)

Table 56

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$5K	$6K	$6K	$6K	$6K	$6K
Req NSS (minus Ch70)	$4K	$6K	$6K	$7K	$7K	$7K	$7K	$8K	$8K	$8K	$8K	$9K	$9K	$9K	$10K	$11K
Actual NSS (minus Req NSS)	$6K	$5K	$6K	$6K	$6K	$7K	$7K	$8K	$8K	$9K	$10K	$9K	$10K	$11K	$11K	$12K
Total NSS	$15K	$16K	$16K	$18K	$19K	$19K	$20K	$21K	$21K	$21K	$23K	$24K	$26K	$26K	$26K	$29K

Data: Leverett

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 57

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$575	$602	$651	$766	$616	$556	$563	$529	$596	$453	$503	$606	$1,041	$840	$756	$608
Administration	$715	$676	$710	$888	$925	$1,029	$809	$842	$1,244	$899	$826	$857	$1,010	$987	$1,061	$953
Instructional Leadership	$1,015	$1,008	$1,072	$1,244	$1,257	$1,393	$1,357	$1,344	$1,431	$1,461	$1,278	$1,317	$1,318	$1,354	$1,430	$1,663
Operations and Maintenance	$1,755	$1,427	$1,532	$1,741	$1,479	$2,421	$2,272	$1,707	$1,209	$1,765	$1,491	$1,458	$2,131	$2,296	$2,292	$2,158
Other Teaching Services	$2,385	$2,040	$2,074	$2,346	$2,540	$2,352	$2,274	$2,281	$2,193	$2,175	$2,477	$2,386	$2,178	$3,119	$3,266	$3,526
Pupil Services	$1,395	$970	$1,096	$1,599	$1,613	$2,392	$2,073	$1,701	$2,082	$2,081	$1,845	$1,641	$2,690	$1,910	$2,635	$2,814
Insurance, Retirement and Other	$2,098	$2,041	$2,253	$2,499	$2,753	$3,245	$3,041	$2,937	$2,943	$3,677	$3,781	$3,686	$4,766	$3,630	$3,611	$3,793
Teachers	$5,218	$5,690	$5,818	$6,301	$6,138	$7,547	$6,868	$6,967	$6,814	$7,967	$7,665	$7,134	$9,224	$6,888	$6,724	$6,395
Total	$15,156	$14,454	$15,206	$17,384	$17,321	$20,935	$19,257	$18,308	$18,512	$20,478	$19,866	$19,085	$24,358	$21,024	$21,775	$21,910

FTE Enrollment

Table 58

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	162	164	161	150	147	124	134	135	134	129	136	142	117	142	140	142
Foundation Enrollment	125	120	123	123	119	118	100	104	101	123	103	112	116	105	112	101
Out-of-District FTE Pupils	7	7	6	9	10	9	8	6	14	8	9	12	9	12	7	3

NSS/Ch70 Funding Components ($)

Table 59

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$3K	$2K	$3K	$3K
Req NSS (minus Ch70)	$5K	$5K	$6K	$6K	$6K	$8K	$6K	$6K	$6K	$8K	$6K	$6K	$9K	$7K	$7K	$7K
Actual NSS (minus Req NSS)	$5K	$5K	$5K	$6K	$7K	$7K	$7K	$8K	$8K	$7K	$9K	$9K	$10K	$10K	$8K	$8K
Total NSS	$12K	$12K	$13K	$14K	$15K	$17K	$16K	$16K	$16K	$17K	$17K	$17K	$21K	$18K	$18K	$17K

Data: Pelham

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 60

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$580	$361	$384	$366	$658	$639	$780	$652	$569	$414	$466	$407	$292	$365	$422	$207
Administration	$390	$398	$478	$391	$664	$796	$806	$980	$739	$731	$489	$574	$656	$688	$614	$917
Instructional Leadership	$1,123	$1,159	$1,089	$1,064	$1,113	$1,252	$1,288	$1,322	$1,278	$1,431	$1,194	$1,609	$1,670	$1,873	$1,782	$1,885
Operations and Maintenance	$920	$847	$925	$884	$992	$947	$1,080	$942	$987	$889	$1,229	$1,304	$1,498	$1,380	$1,524	$1,614
Other Teaching Services	$2,184	$2,109	$2,166	$2,026	$1,937	$2,063	$2,218	$2,541	$2,850	$2,269	$2,273	$2,324	$2,540	$2,292	$2,594	$3,010
Pupil Services	$1,032	$1,090	$1,347	$1,507	$1,584	$1,615	$1,696	$1,797	$1,774	$1,672	$1,732	$1,642	$2,112	$2,203	$1,888	$3,610
Insurance, Retirement and Other	$2,615	$2,585	$2,602	$2,897	$3,052	$3,283	$3,376	$3,473	$3,863	$4,561	$3,791	$4,168	$4,850	$4,157	$3,983	$4,670
Teachers	$5,889	$5,474	$5,627	$5,576	$5,035	$6,090	$6,540	$6,418	$5,904	$6,310	$6,129	$6,860	$7,406	$6,714	$6,430	$7,127
Total	$14,733	$14,023	$14,618	$14,711	$15,035	$16,685	$17,784	$18,125	$17,964	$18,277	$17,303	$18,888	$21,024	$19,672	$19,237	$23,040

FTE Enrollment

Table 61

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	118	125	122	128	132	128	123	123	130	127	134	125	106	119	134	126
Foundation Enrollment	85	81	81	68	63	67	70	73	74	81	83	82	84	70	65	63
Out-of-District FTE Pupils	3	3	4	1	4	7	5	7	11	12	10	4	8	6	5	9

NSS/Ch70 Funding Components ($)

Table 62

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K	$2K
Req NSS (minus Ch70)	$4K	$4K	$4K	$4K	$4K	$4K	$5K	$5K	$5K	$5K	$5K	$6K	$7K	$5K	$5K	$5K
Actual NSS (minus Req NSS)	$6K	$5K	$5K	$5K	$5K	$5K	$5K	$6K	$7K	$8K	$7K	$8K	$10K	$9K	$9K	$10K
Total NSS	$12K	$11K	$11K	$11K	$11K	$11K	$12K	$13K	$13K	$15K	$14K	$15K	$19K	$17K	$16K	$17K

Data: Shutesbury

PPE ($/pupil), FTE Enrollment, and NSS/Ch70 Funding ($)

PPE by Category ($/pupil)

Table 63

Category	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Other	$580	$498	$564	$865	$704	$515	$636	$684	$1,510	$420	$385	$873	$1,296	$551	$1,102	$545
Administration	$652	$943	$767	$836	$877	$726	$884	$1,084	$1,040	$846	$856	$938	$925	$1,100	$934	$1,015
Instructional Leadership	$969	$1,138	$1,149	$1,198	$1,227	$1,003	$1,192	$1,517	$1,604	$1,481	$1,517	$1,541	$1,707	$1,736	$1,323	$2,103
Operations and Maintenance	$1,180	$1,079	$1,221	$1,276	$1,251	$1,338	$1,384	$1,637	$1,791	$1,941	$1,663	$1,916	$2,665	$2,048	$2,051	$2,754
Other Teaching Services	$2,185	$2,447	$2,361	$2,193	$2,179	$2,591	$2,164	$2,817	$3,301	$3,491	$3,545	$3,560	$3,722	$5,320	$3,441	$4,359
Pupil Services	$1,292	$1,128	$1,195	$1,556	$1,628	$1,418	$1,427	$1,340	$2,165	$2,301	$2,206	$2,198	$2,456	$2,748	$2,946	$2,962
Insurance, Retirement and Other	$2,332	$2,687	$2,596	$2,690	$2,564	$2,484	$2,328	$3,107	$3,773	$4,388	$2,970	$3,963	$3,350	$3,154	$4,007	$3,501
Teachers	$4,821	$5,363	$5,603	$5,169	$5,509	$6,012	$5,620	$6,612	$7,043	$7,838	$7,914	$8,204	$8,933	$10,075	$8,898	$9,669
Total	$14,011	$15,283	$15,456	$15,783	$15,939	$16,087	$15,635	$18,798	$22,227	$22,706	$21,056	$23,193	$25,054	$26,732	$24,702	$26,908

FTE Enrollment

Table 64

FTE Series	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
In-District FTE Pupils	162	151	146	151	150	157	156	131	120	124	127	125	113	115	123	110
Foundation Enrollment	156	149	141	138	143	132	141	146	118	116	118	117	105	98	100	111
Out-of-District FTE Pupils	7	5	7	10	9	13	9	12	13	16	18	15	16	18	19	18

NSS/Ch70 Funding Components ($)

Table 65

Component	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ch70 Aid	$4K	$4K	$4K	$4K	$4K	$4K	$4K	$5K	$5K	$5K	$5K	$5K	$6K	$5K	$5K	$6K
Req NSS (minus Ch70)	$4K	$5K	$5K	$4K	$5K	$4K	$4K	$6K	$5K	$6K	$5K	$6K	$6K	$6K	$6K	$7K
Actual NSS (minus Req NSS)	$4K	$5K	$6K	$6K	$6K	$6K	$6K	$7K	$9K	$10K	$9K	$11K	$11K	$13K	$10K	$11K
Total NSS	$12K	$13K	$14K	$14K	$14K	$14K	$15K	$17K	$19K	$20K	$20K	$22K	$23K	$24K	$21K	$24K

Appendix D. Additional Visualizations

Scatterplot of enrollment vs. per-pupil expenditure with quartile boundaries (2019)

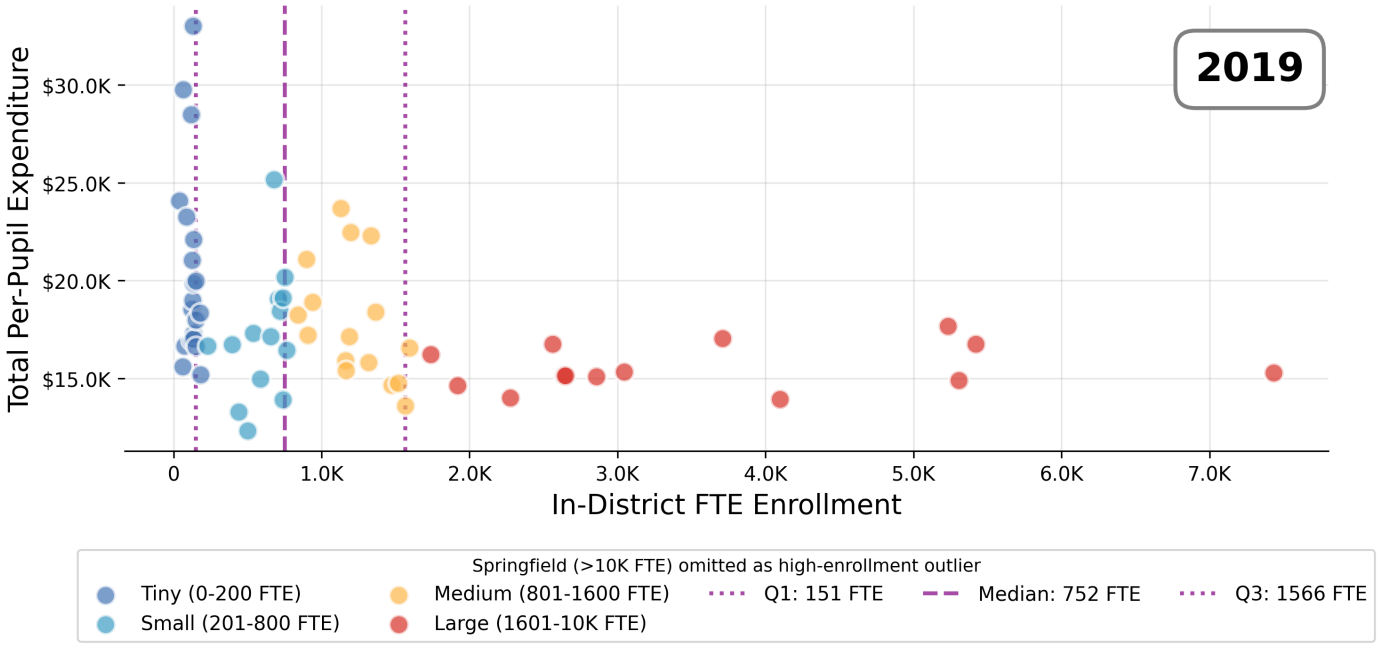

Figure 31

This appendix contains historical scatterplots and geographic maps showing the evolution of district enrollment and per-pupil expenditures over time. These visualizations provide context for understanding how enrollment patterns and spending levels have shifted across Western Massachusetts districts from 2009 to 2024.

This scatterplot shows the relationship between district enrollment (x-axis) and per-pupil expenditure (y-axis) for Western Massachusetts traditional districts in 2019. Each point represents one district, colored by enrollment cohort. Horizontal lines show quartile boundaries used to define cohorts.

Appendix D. Additional Visualizations (continued)

Geographic map showing district locations and enrollment cohorts (2019)

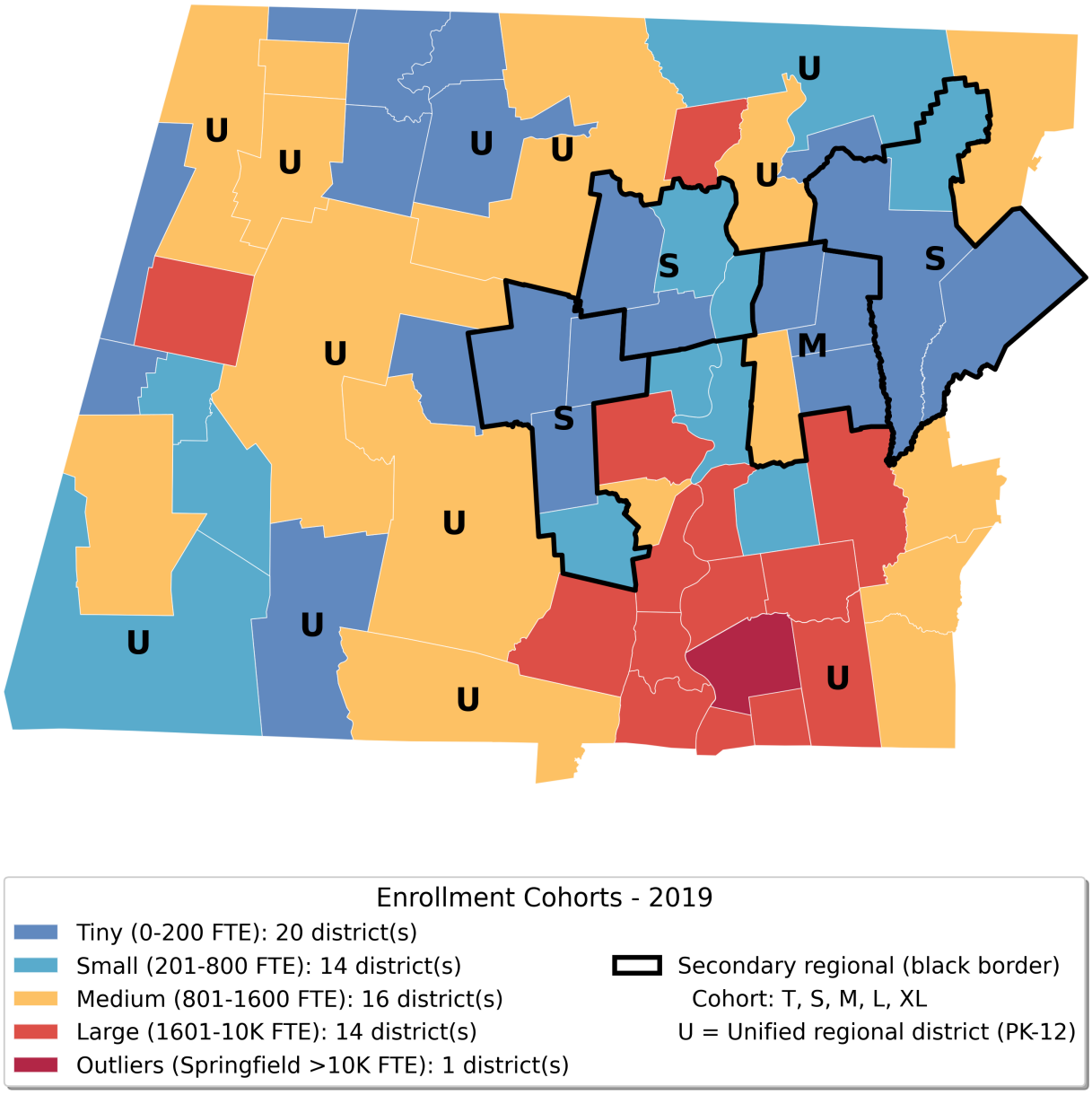

Figure 32

Geography matters for understanding school costs. This map shows where enrollment cohorts cluster and how regional district boundaries cross municipal lines.

Appendix D. Additional Visualizations (continued)

Geographic map showing 2019 PPE vs enrollment cohort baseline

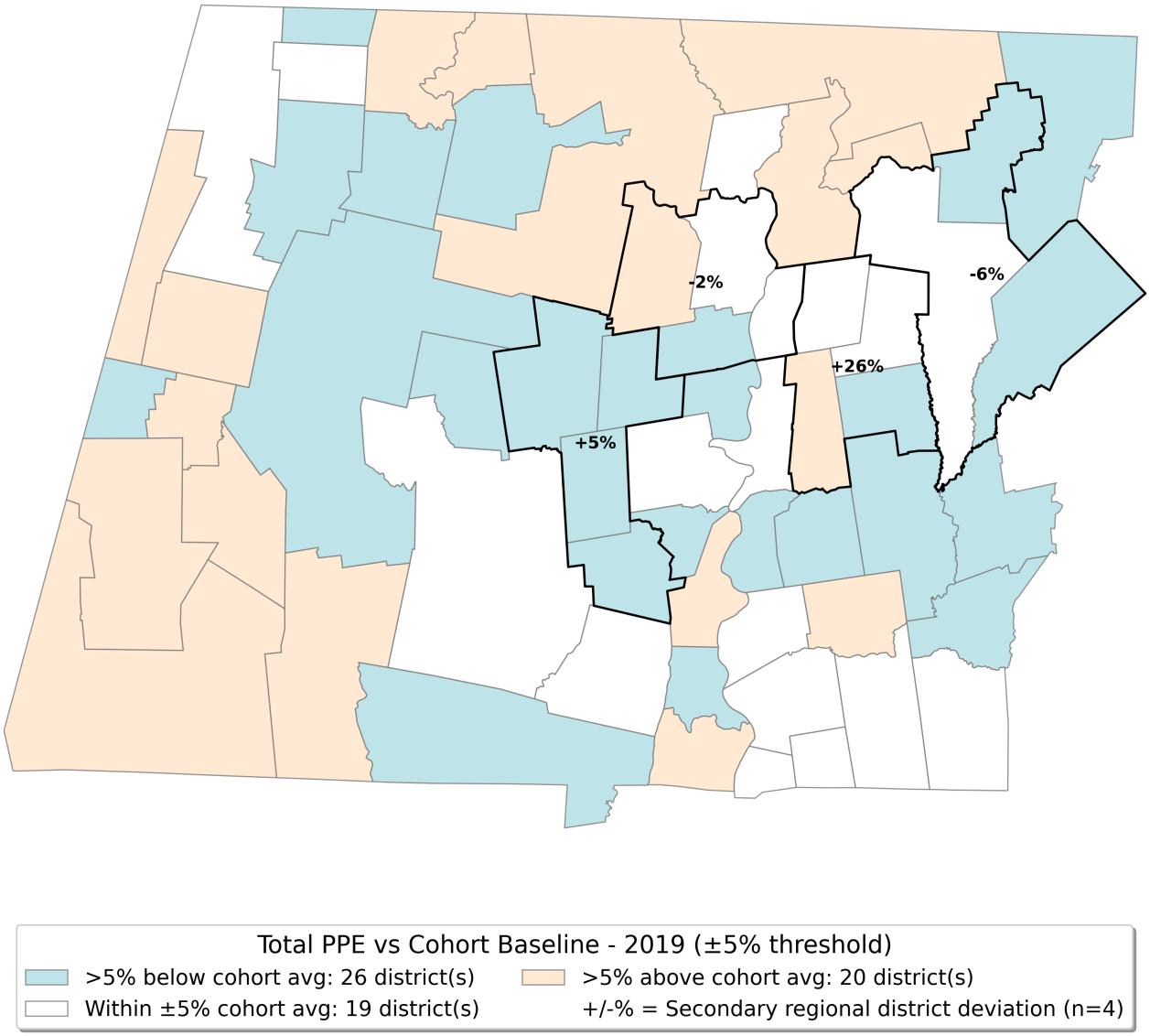

Figure 33

This map shows each district's 2024 per-pupil spending compared to its enrollment cohort baseline (weighted average of all Western MA districts in that cohort).

Appendix D. Additional Visualizations (continued)

Geographic map showing 10-year PPE growth (2009-2019) vs enrollment cohort baseline

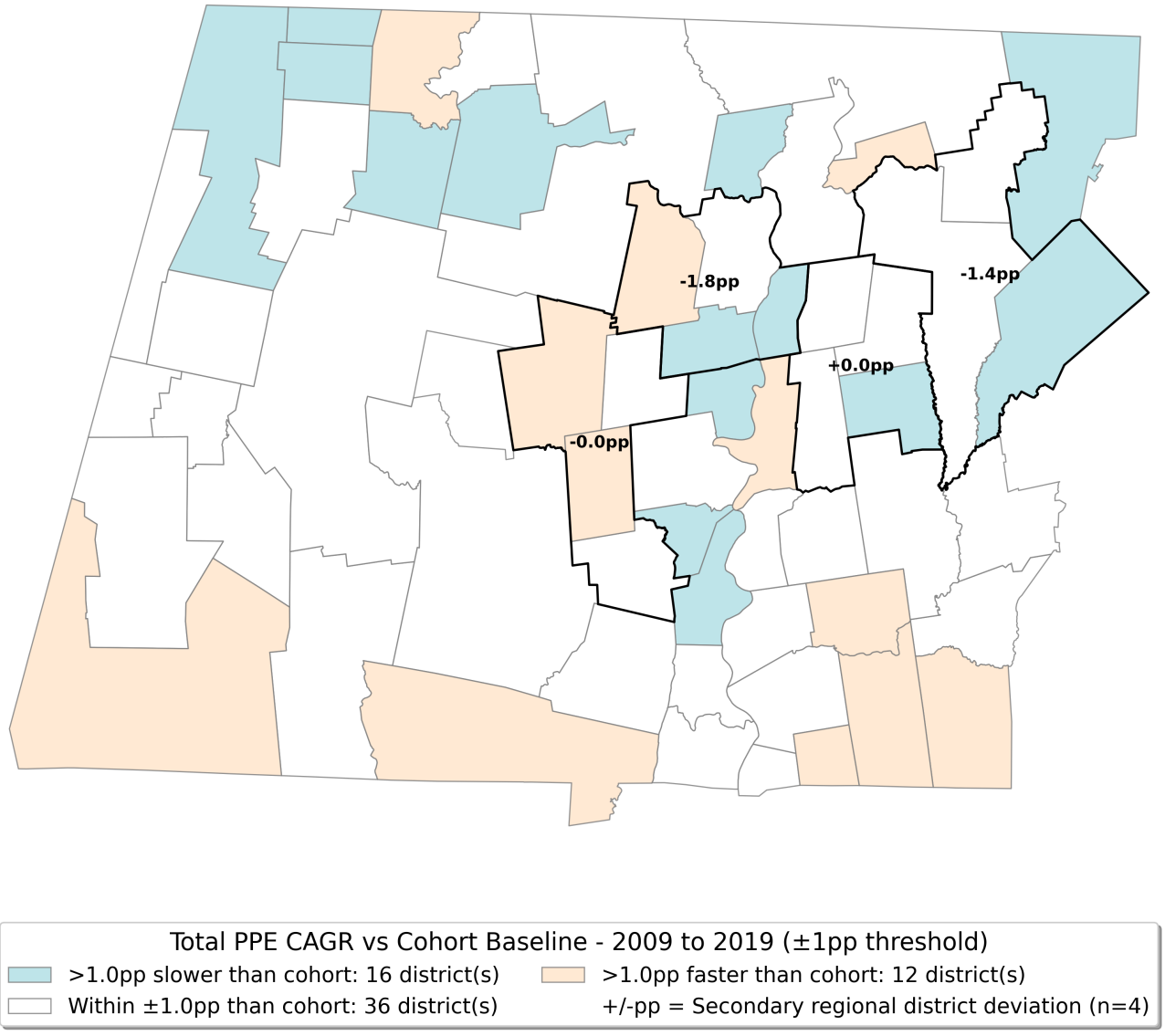

Figure 34

This map shows each district's 15-year spending growth rate (CAGR, 2009-2024) compared to its enrollment cohort baseline growth rate.

Appendix D. Additional Visualizations (continued)

Scatterplot of enrollment vs. per-pupil expenditure with quartile boundaries (2014)

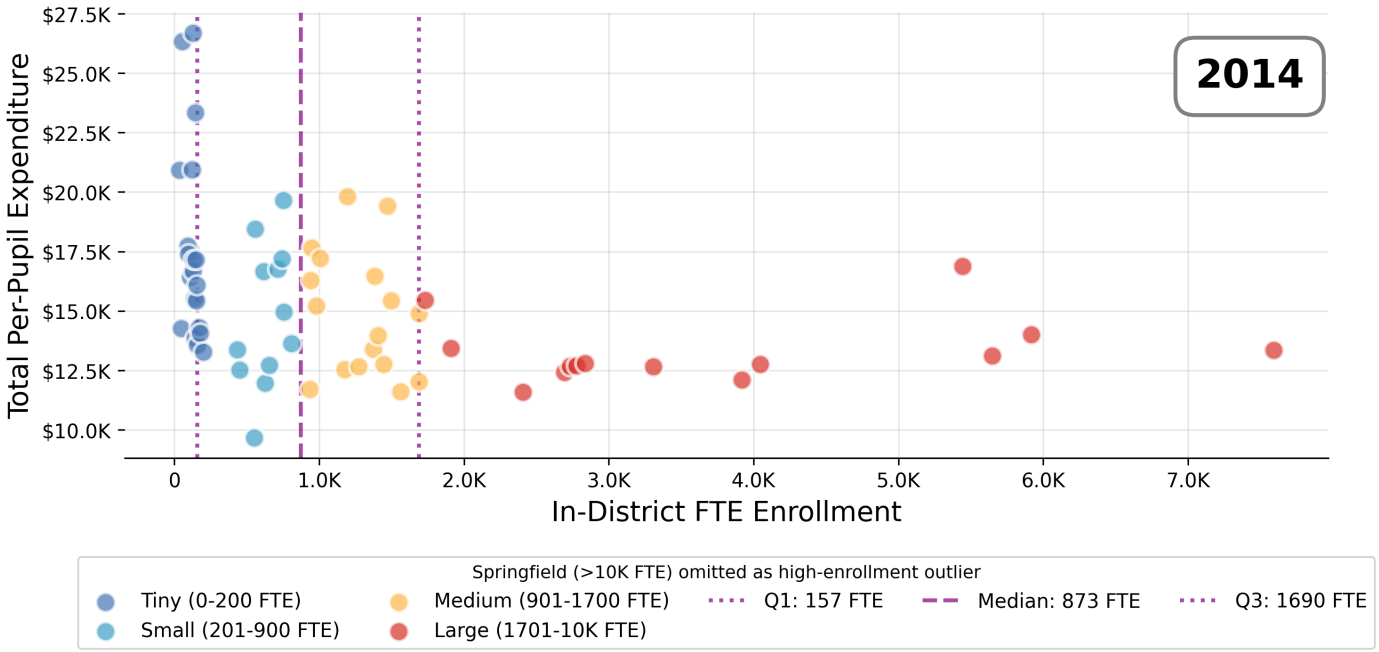

Figure 35

This scatterplot shows the relationship between district enrollment (x-axis) and per-pupil expenditure (y-axis) for Western Massachusetts traditional districts in 2014. Each point represents one district, colored by enrollment cohort. Horizontal lines show quartile boundaries used to define cohorts.

Appendix D. Additional Visualizations (continued)

Geographic map showing district locations and enrollment cohorts (2014)

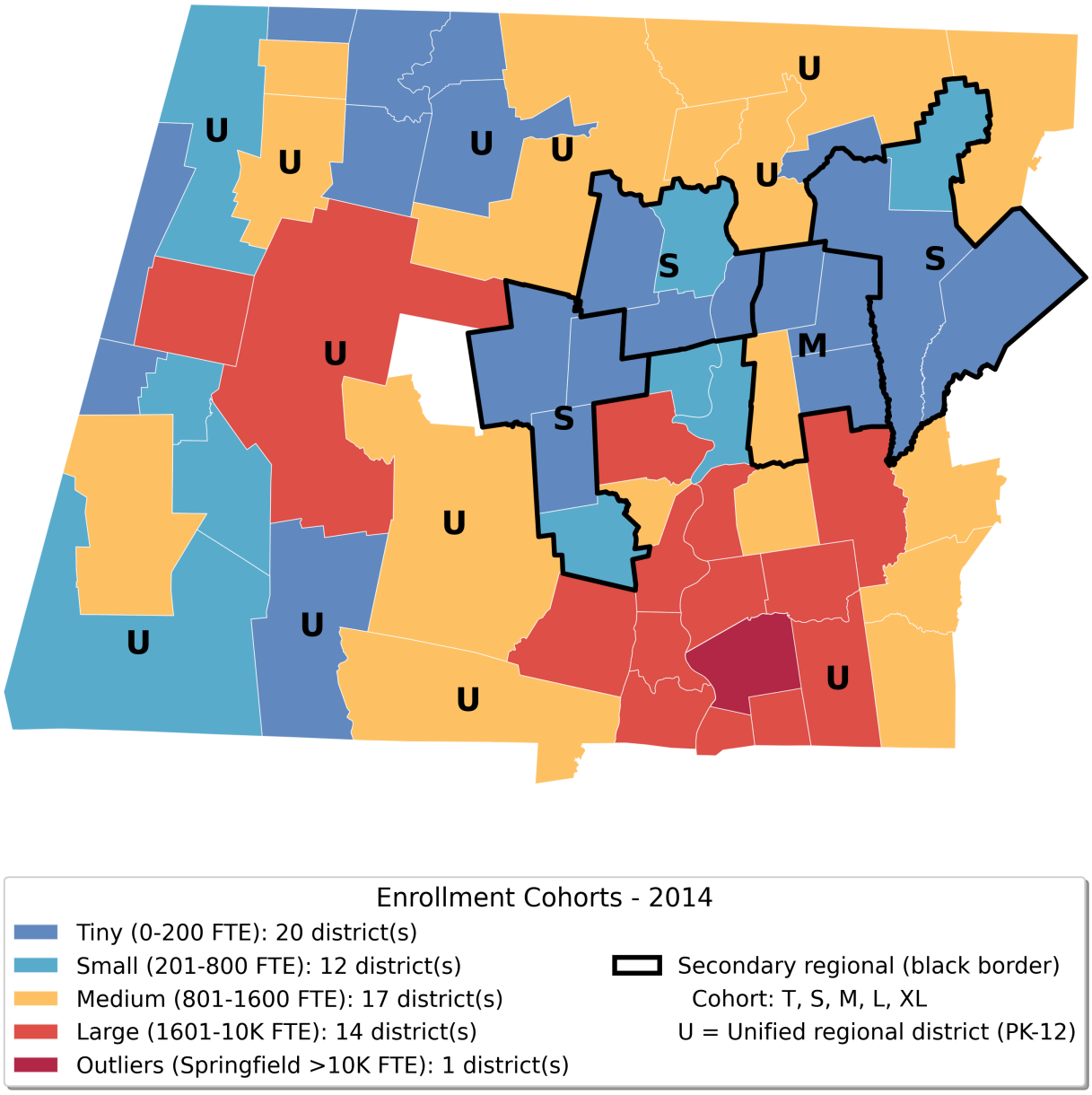

Figure 36

Geography matters for understanding school costs. This map shows where enrollment cohorts cluster and how regional district boundaries cross municipal lines.

Appendix D. Additional Visualizations (continued)

Geographic map showing 2014 PPE vs enrollment cohort baseline

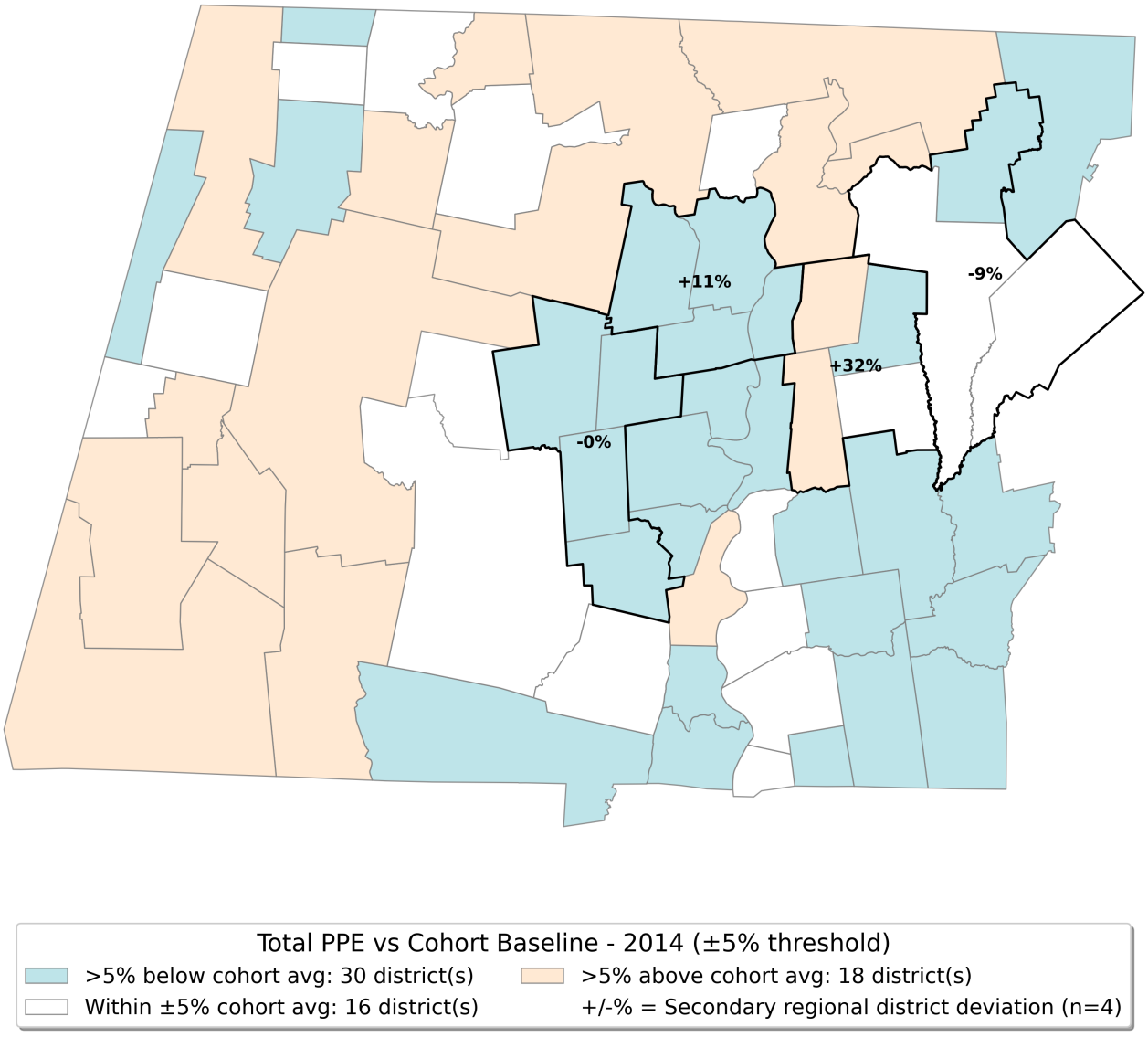

Figure 37

This map shows each district's 2024 per-pupil spending compared to its enrollment cohort baseline (weighted average of all Western MA districts in that cohort).

Appendix D. Additional Visualizations (continued)

Geographic map showing 5-year PPE growth (2009-2014) vs enrollment cohort baseline

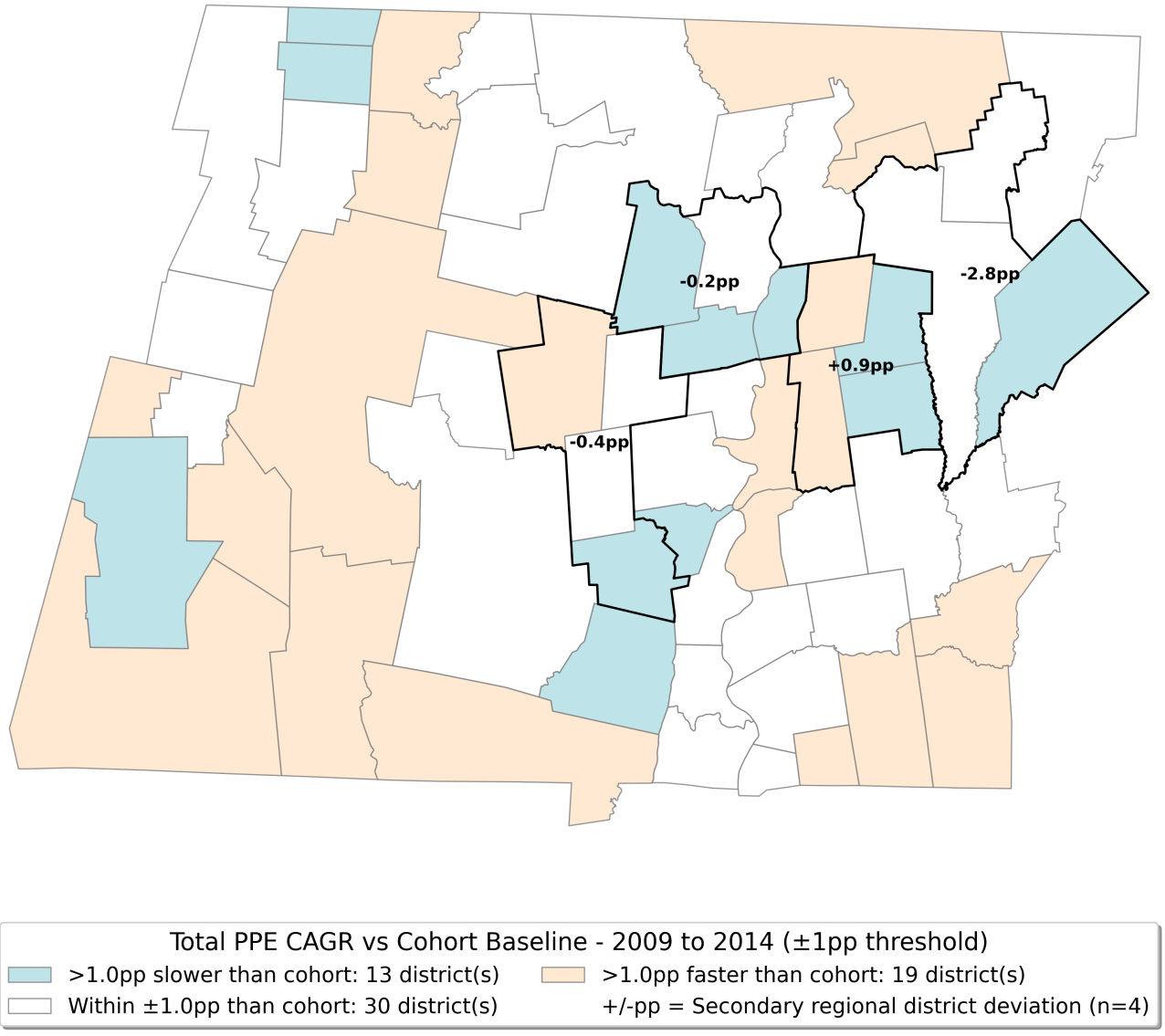

Figure 38

This map shows each district's 15-year spending growth rate (CAGR, 2009-2024) compared to its enrollment cohort baseline growth rate.

Appendix D. Additional Visualizations (continued)

Scatterplot of enrollment vs. per-pupil expenditure with quartile boundaries (2009)

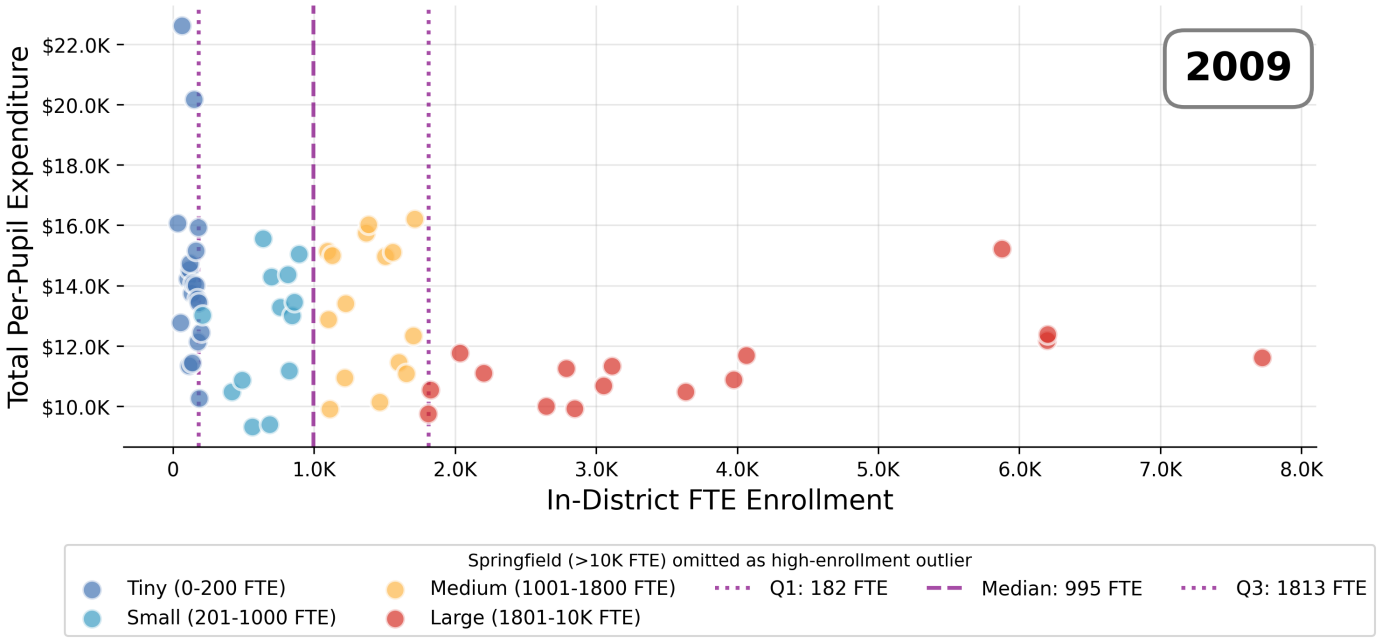

Figure 39

This scatterplot shows the relationship between district enrollment (x-axis) and per-pupil expenditure (y-axis) for Western Massachusetts traditional districts in 2009. Each point represents one district, colored by enrollment cohort. Horizontal lines show quartile boundaries used to define cohorts.

Appendix D. Additional Visualizations (continued)

Geographic map showing district locations and enrollment cohorts (2009)

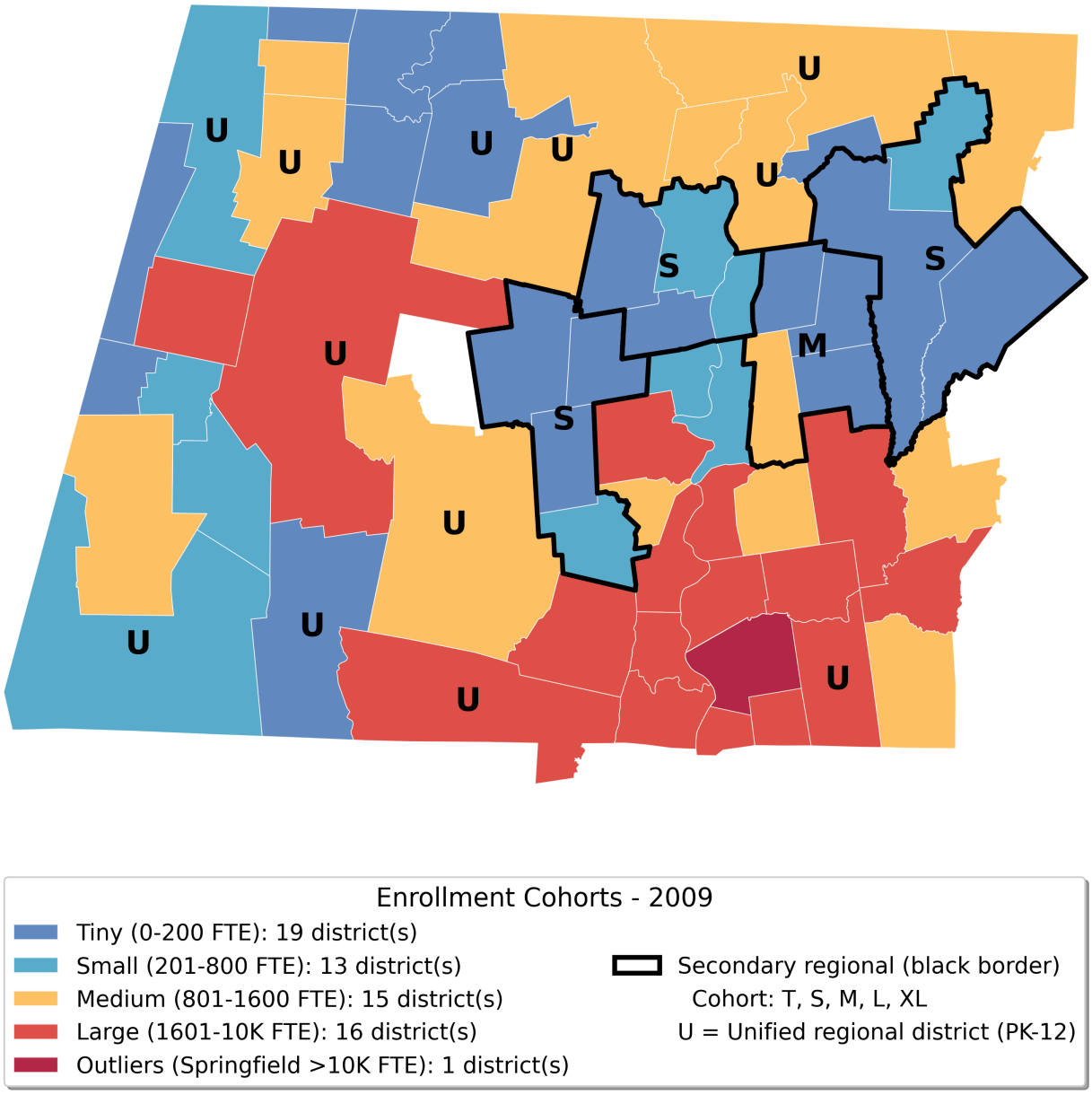

Figure 40

Geography matters for understanding school costs. This map shows where enrollment cohorts cluster and how regional district boundaries cross municipal lines.

Appendix D. Additional Visualizations (continued)

Geographic map showing 2009 PPE vs enrollment cohort baseline

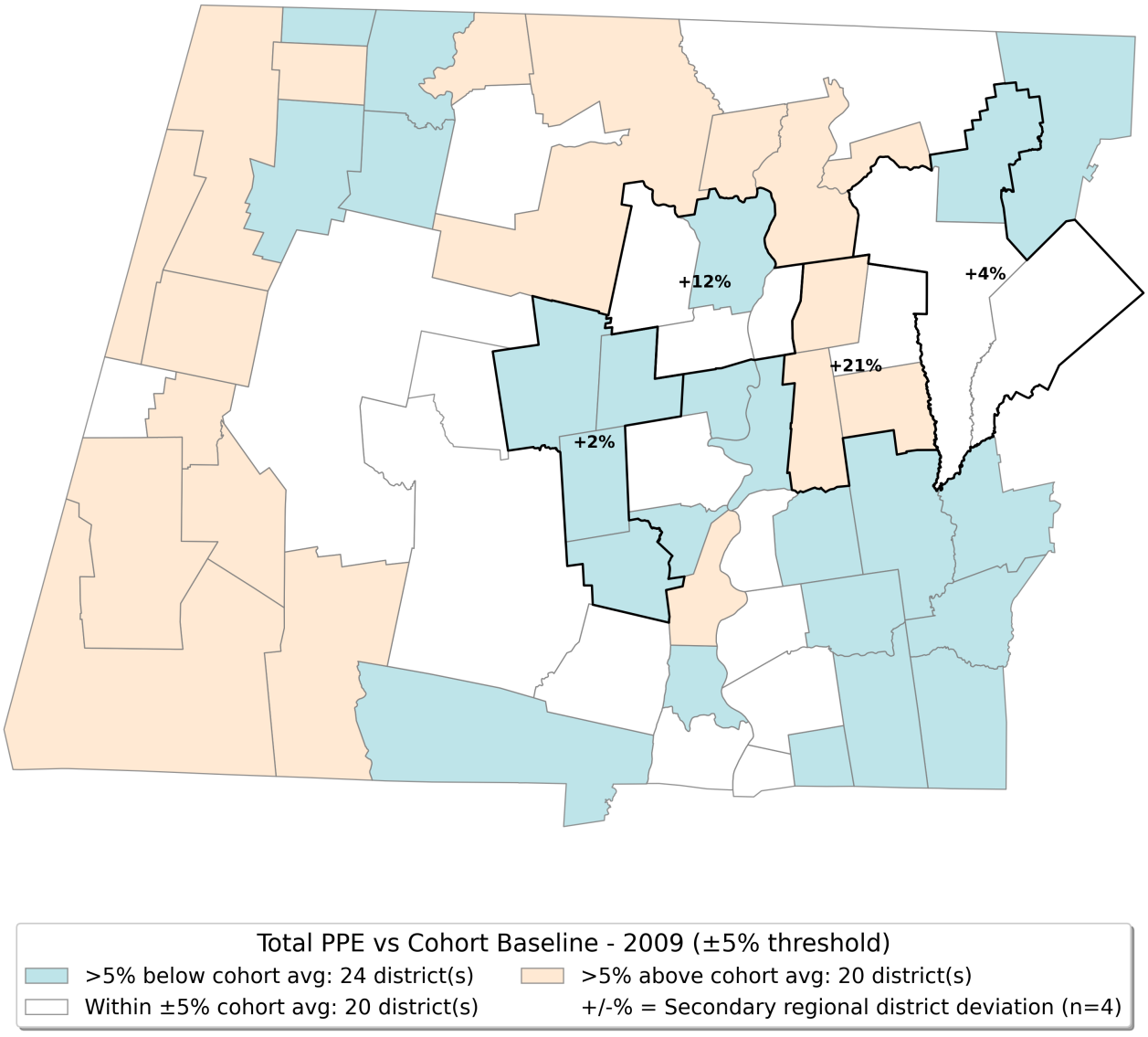

Figure 41

This map shows each district's 2024 per-pupil spending compared to its enrollment cohort baseline (weighted average of all Western MA districts in that cohort).