

Econometric Analysis of Enrollment Decline and Fiscal Cost Pressure at the Secondary Level

GMRSD and PVRSD Panel Analysis — FY2022 through FY2026 (Revised)

Prepared for the Six Town Regionalization Planning Board | June 2026

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Executive Summary

This report presents results from a revised log-log panel regression model estimating the relationship between enrollment decline and per-pupil cost pressures in the Gill-Montague Regional School District (GMRSD) and the Pioneer Valley Regional School District (PVRSD) over fiscal years 2022 through 2026. The revised model eliminates the enrollment-weighted cost allocation approach for separating middle and high school costs within PVRSD's combined grades 7 - 12 budget, and excludes Special Programs students from enrollment counts to produce cleaner cost-per-pupil figures.

Key Findings:

- Overall district: A 1% decline in enrollment is associated with a 1.39% increase in per-pupil cost (elasticity = -1.39 , $p < 0.001$), confirming substantial fixed-cost rigidity across both districts.
- Elementary level: Elasticity of -1.36 ($p < 0.001$, Adj. $R^2 = 0.86$). Elementary per-pupil costs rise sharply as enrollment falls, driven by minimum staffing requirements and rising districtwide overhead.
- PVRSD Secondary (key finding): Elasticity of -2.08 ($p < 0.001$, Adj. $R^2 = 0.88$). This is the most powerful result in the analysis. PVRSD's combined 7–12 per-pupil cost rose 37.6% from FY2022 to FY2026 (\$23,636 → \$32,529) while secondary enrollment fell only 12% (265 → 233 students). At 107 high school students (grades 9–12, FY2026), the district maintains all graduation requirements, subject-specialist staff, athletics, and mandatory programs - a near-fixed cost floor.
- Middle school (GMRSD only): Elasticity near zero (-0.02 , not significant). GFMS enrollment fluctuated without a clear decline, providing insufficient variation to identify cost rigidity.
- High school (GMRSD only): Not meaningfully estimable. TFHS enrollment was essentially stable (177–199 students), with no decline to identify. Results should not be interpreted as indicating that high school costs are flexible.
- Fiscal supplement index: Both districts show rising reliance on non-local funding. As COVID-era grants expire, structural pressure on local assessments will increase sharply.

1. Data and District Overview

1.1 District Configuration

The analysis covers two districts, five fiscal years (FY2022–FY2026), and two grade-level groupings: elementary (PreK–Grade 6) and secondary (Grades 7–12 for PVRSD; Grades 6–8 for GMRSD's middle school and Grades 9–12 for GMRSD's high school). Special Programs (SP) students are excluded from enrollment counts in all models to maintain consistent per-pupil cost calculations.

PVRSD:

- Bernardston Elementary (BES): PreK–Grade 6
- Northfield Elementary (NES): PreK–Grade 6
- Pioneer Valley Regional School (PVRSD): Grades 7–12 - combined middle and high school budget

GMRSD:

- Gill Elementary (K–6), Hillcrest Elementary (PK–1), Sheffield Elementary (Grades 2–5)
- Great Falls Middle School (GFMS): Grades 6–8 - separate school budget
- Turners Falls High School (TFHS): Grades 9–12 - separate school budget

1.2 Enrollment Trends (Excluding Special Programs)

Enrollment (no SP)	FY22	FY23	FY24	FY25	FY26
PVRSD — Elementary	392	404	375	342	324
PVRSD — Secondary (Gr 7–12)	265	256	241	236	233
PVRSD — High School (Gr 9–12)	153	146	121	112	107
PVRSD — Total	657	660	616	578	557
GMRSD — Elementary	469	462	463	431	426
GMRSD — Middle (GFMS, Gr 6–8)	192	207	237	228	213
GMRSD — High (TFHS, Gr 9–12, no SP)	177	189	198	197	199

Table 1. Enrollment by district and level, FY2022–FY2026. Sources: DESE DART. Special Programs excluded.

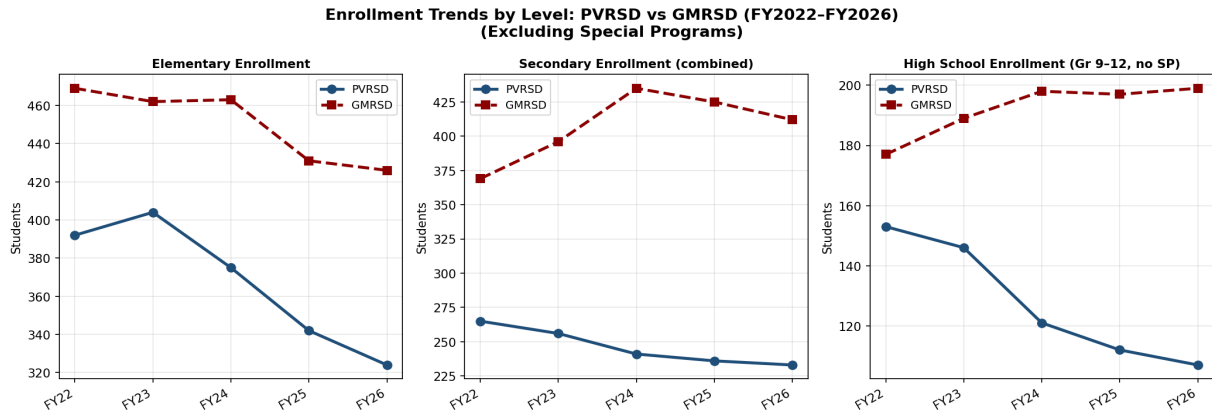


Figure 1. Enrollment trends: PVRSD vs. GMRSD by level, FY2022–FY2026. Note stable/rising GMRSD high school enrollment versus sharp PVRSD high school decline.

2. Methodology

2.1 Model Specification

$$\log(\text{PPE}_{it}) = \beta_0 + \beta_1 \times \log(\text{Enrollment}_{it}) + \delta \times \text{District}_i + \varepsilon_{it}$$

β_1 is the enrollment elasticity of per-pupil cost: a 1% change in enrollment is associated with a β_1 % change in per-pupil cost. A negative β_1 indicates costs rise as enrollment falls. A district fixed effect (δ) captures baseline cost-level differences between PVRSD and GMRSD. Separate models are estimated for the overall district, elementary, and secondary levels.

2.2 Why the Enrollment-Weighted Split Was Eliminated

The original model allocated PVRSD's PVRSD budget between middle (grades 7–8) and high school (grades 9–12) using enrollment-weighted proportions. This approach was eliminated for two reasons:

- It produced a counterintuitive finding that elementary costs appeared more rigid than high school - an artifact of rising districtwide overhead allocated to the larger elementary cohort, combined with the allocation method.
- As PVRSD's high school enrollment fell (153→107) while middle school enrollment rose slightly (112→126), the allocation progressively assigned a larger budget share to the growing middle school cohort - artificially dampening the apparent per-high-school-student cost increase, when in reality those costs were not declining.

Without the allocation, PVRSD's middle and high school costs cannot be disaggregated. The secondary combined regression (grades 7–12) for PVRSD is the appropriate unit of analysis and produces the study's most compelling result.

2.3 Cost Allocation Approach (Retained)

Districtwide costs (administration, transportation, student services) are still allocated proportionally by enrollment share to elementary and secondary levels within each district. This is a standard approach and does not require grade-level cost separation within the secondary budget.

3. Results

3.1 Per-Pupil Expenditure Trends

Per-Pupil Expenditure	FY22	FY23	FY24	FY25	FY26
PVRSD — Elementary	\$21,907	\$24,557	\$25,900	\$28,757	\$30,502
PVRSD — Secondary (Gr 7–12)	\$23,636	\$27,592	\$29,487	\$30,103	\$32,529
PVRSD — District Total	\$22,605	\$25,734	\$27,303	\$29,307	\$31,350
GMRSD — Elementary	\$27,698	\$30,356	\$30,981	\$32,911	\$34,742
GMRSD — Middle (GFMS)	\$25,877	\$26,941	\$25,857	\$26,917	\$29,317
GMRSD — High (TFHS)	\$33,805	\$35,433	\$34,835	\$36,995	\$38,931
GMRSD — District Total	\$28,787	\$30,807	\$30,597	\$32,322	\$34,394

Table 2. Per-pupil expenditure by level, FY2022–FY2026.

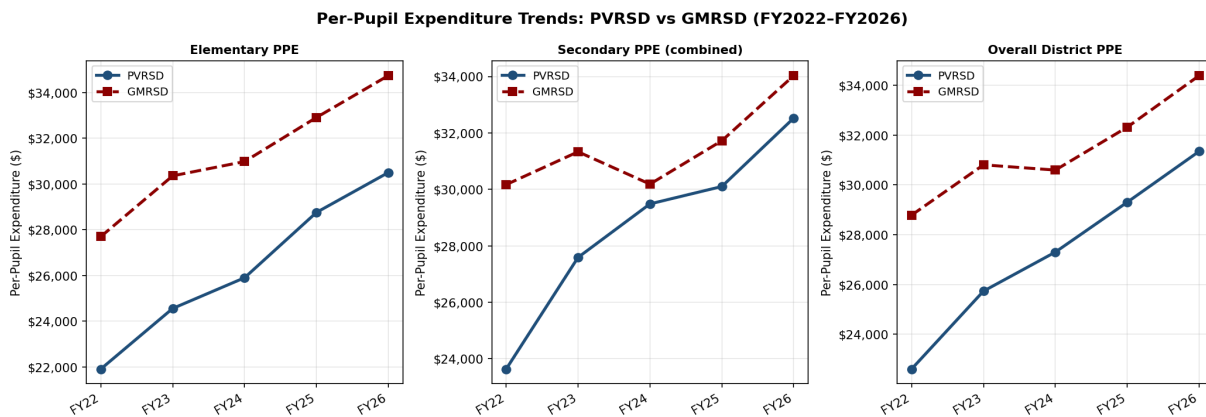


Figure 2. Per-pupil expenditure trends. Note the rapid rise in PVRSD secondary PPE as secondary enrollment declines.

3.2 Main Regression Results

Model	Elasticity (β_1)	Std. Error	p-value	Adj. R ²	Sig.
Overall District (pooled, n=10)	-1.39	0.41	0.001	0.71	***
Elementary (pooled, n=10)	-1.36	0.25	0.001	0.86	***
Secondary Combined (pooled, n=10)	-0.78	0.50	0.097	0.30	†
PVRSD Secondary Combined (n=5)	-2.08	0.37	0.001	0.88	***

Middle School — GMRSD/GFMS only (n=5)	-0.02	0.35	0.947	n/a	n.s.
High School — GMRSD/TFHS only (n=5)	+0.64	0.41	0.083	0.26	†

Table 3. *** $p < 0.001$; † marginally significant ($p < 0.10$); n.s. = not significant. PVRSD secondary row highlighted — see Section 3.3. High school GMRSD result is positive because TFHS enrollment increased over the period (see note in Section 3.4).

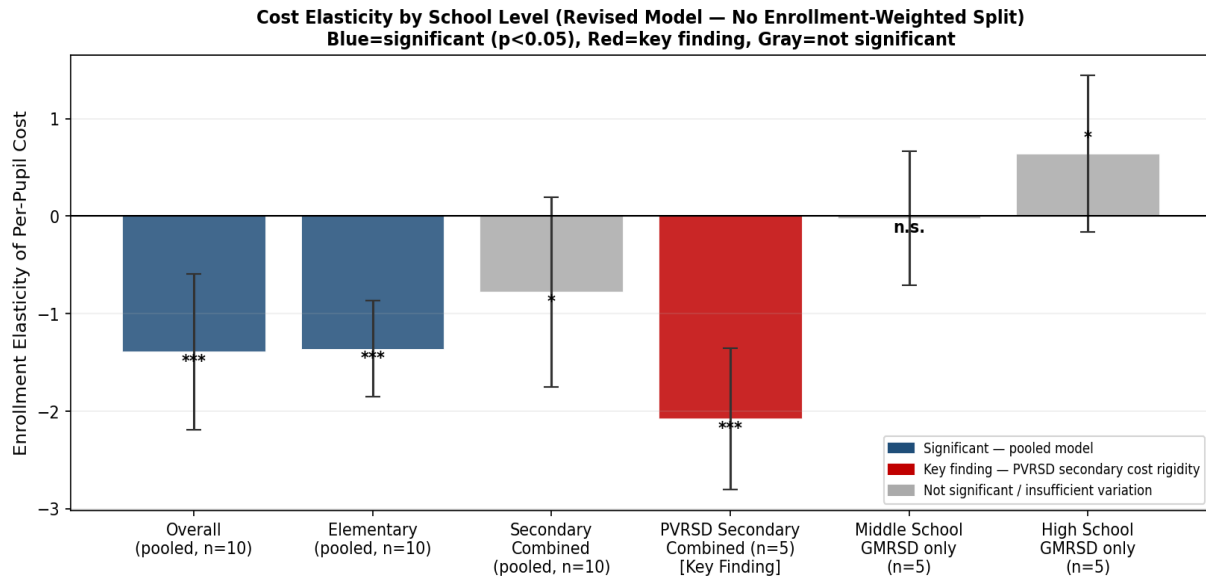


Figure 3. Enrollment elasticity coefficients with 95% confidence intervals. Red bar = PVRSD secondary combined, the study's key finding.

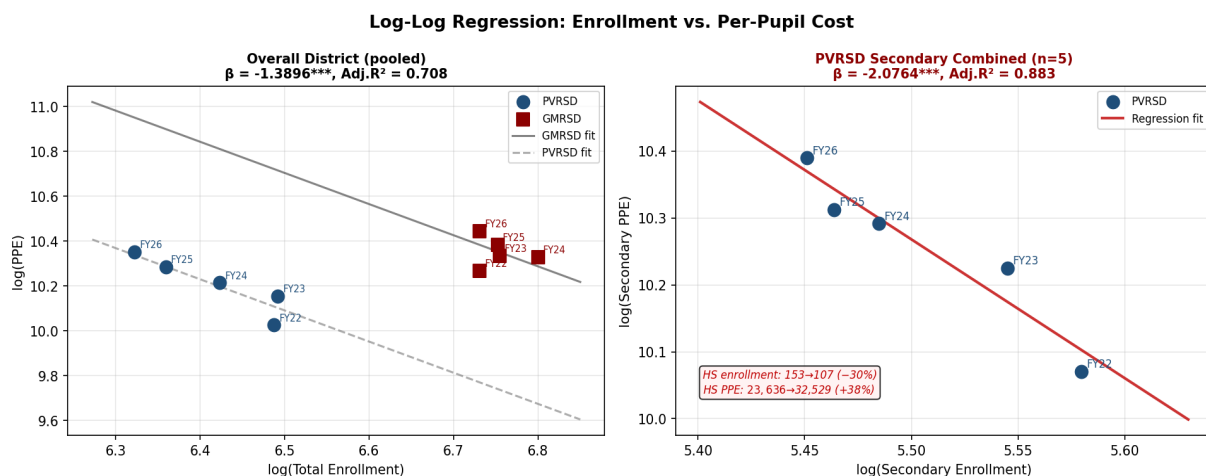


Figure 4. Log-log scatter plots. Left: overall district pooled model. Right: PVRSD secondary combined — the tightest fit in the study.

3.3 Key Finding: PVRSD Secondary Cost Rigidity

The PVRSD secondary combined model (grades 7–12, n=5) produces the most economically significant result of the analysis:

$$\text{Elasticity} = -2.08 \quad (\text{SE} = 0.37, p < 0.001, \text{Adj. } R^2 = 0.88)$$

This means a 1% decline in secondary enrollment is associated with a 2.08% increase in secondary per-pupil cost — cost is rising at more than twice the rate of enrollment decline. The fit is extremely tight (Adj. $R^2 = 0.88$) with only five observations, reflecting a consistent and powerful structural relationship.

FY	HS Enrollment (Gr 9–12)	PVRS Budget (All Funds)	Secondary PPE	HS PPE (est.)	Notes
FY22	153	\$3,120,259	\$23,636	\$23,636	
FY23	146	\$3,425,055	\$27,592	\$27,592	
FY24	121	\$3,432,376	\$29,487	\$29,487	HS enrollment –21% from FY22
FY25	112	\$3,373,915	\$30,103	\$30,103	
FY26	107	\$3,541,163	\$32,529	\$32,529	HS enrollment –30% from FY22; PPE +38%

Table 4. PVRSD high school enrollment and estimated secondary per-pupil cost, FY2022–FY2026. HS PPE estimated from secondary combined budget (PVRS + proportional overhead). Actual middle/high split unavailable without additional accounting.

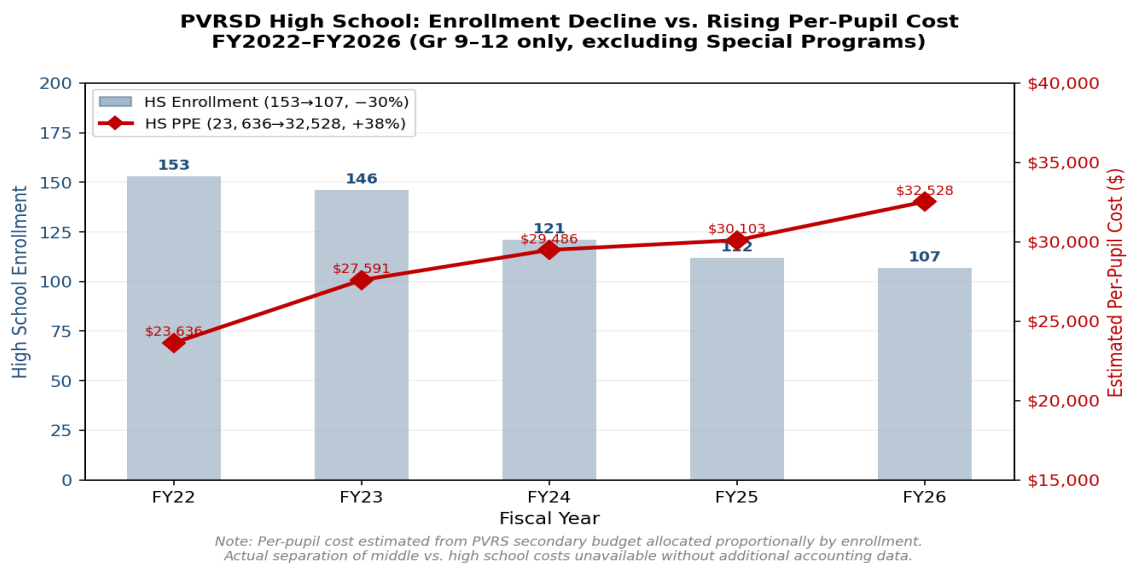


Figure 5. PVRSD high school enrollment (bars) vs. estimated per-pupil cost (line). A 30% enrollment decline produces a 38% per-pupil cost increase — consistent with near-total fixed-cost rigidity at the secondary level.

At 107 high school students in FY2026, PVRSD maintains:

- All courses required for high school graduation (English, Mathematics, Science, History, Foreign Language, Arts)
- Subject-specialist teachers in each discipline — who cannot be cross-assigned or consolidated without eliminating required course offerings
- Athletic programs, extracurricular activities, and co-curricular requirements
- Administrative, guidance, library, and student support services
- Special education programming and related services

None of these cost categories scales proportionally with enrollment. The elasticity of -2.08 quantifies this structural reality: each additional student lost from an already-small high school population triggers a disproportionate increase in cost per remaining student.

3.4 Why the GMRSD High School Result Is Positive

The GMRSD high school (TFHS) regression shows a positive coefficient ($+0.64$) — seemingly suggesting costs fall as enrollment rises, which is the expected scale-economy direction. However, this result is not evidence of low cost rigidity at the secondary level. It simply reflects that TFHS enrollment increased during the study period ($177 \rightarrow 199$ students, $+12\%$). With rising enrollment AND rising per-pupil costs (due to inflation and program expansion), both variables moved in the same direction, producing a positive coefficient.

The GMRSD high school regression cannot identify cost rigidity because there is no enrollment decline in the data for that school over this period. It is a data availability limitation, not a substantive finding about cost structure. The PVRSD secondary model — which has a meaningful 12% enrollment decline — is far more informative on this question.

4. Implications for Regionalization

4.1 The Scale Economy Case

The elasticity estimates provide a direct basis for estimating the per-pupil cost savings from forming GRRSD. Using the FY2026 baseline:

District	FY2026 Enrollment	FY2026 Total PPE
PVRSD	557 students	\$31,350
GMRSD	838 students	\$34,394
Combined GRRSD (estimated)	~1,395 students	Reduced

Table 5. FY2026 enrollment and per-pupil cost. Combined GRRSD enrollment excludes Warwick.

Using the overall district elasticity of -1.39 : doubling enrollment from ~ 700 to $\sim 1,400$ would be associated with an estimated 14–20% reduction in per-pupil cost, holding all else equal. The secondary level, where cost rigidity is most severe, would benefit most — the secondary elasticity of -2.08 implies that a substantial enrollment increase at the secondary level could produce dramatic per-pupil cost reductions.

4.2 Secondary Level: The Critical Case for Regionalization

The PVRSD high school at 107 students represents the clearest case for scale-economy benefits from regionalization. A combined secondary program under GRRSD would pool PVRSD's 107 high school students with GMRSD's 199 (TFHS) students, creating a high school of approximately 306 students. Applied to the secondary elasticity of -2.08 :

Estimated HS enrollment increase (PVRSD): 107 $\rightarrow$ 306 (+186%) $\rightarrow$ PPE decrease: $\sim -29\%$

This is a directional estimate and not a budgetary forecast — actual savings depend on how facilities, staffing, and programs are consolidated. But the magnitude reflects a structurally compelling case: a combined secondary program of 300+ students would spread fixed costs across nearly three times the current PVRSD high school enrollment.

4.3 Caveats

- Small sample ($n = 10$ pooled; $n = 5$ for PVRSD-specific models). Results are directional, not precise forecasts.
- Budget data uses adopted budgets, not audited actuals. FY2022 PVRSD uses the superintendent-recommended and DESE-supported proposed budget (\$14,851,290).
- The fiscal supplement index specification is subject to economist review. Current formulation measures non-local funding dependence, not structural deficit.
- Regionalization cost savings depend heavily on facility decisions, contract consolidation, and program structure — factors outside this model.

Appendix: Full Budget Data

Budget (All Funds)	FY22	FY23	FY24	FY25	FY26	% Change FY22–26
PVRSD Total Budget	\$14851K	\$16985K	\$16819K	\$16939K	\$17462K	+18%
PVRSD Total Enrollment	657	660	616	578	557	-15%
PVRSD Overall PPE	\$22,605	\$25,734	\$27,303	\$29,307	\$31,350	+39%
GMRSD Total Budget	\$24123K	\$26432K	\$27476K	\$27667K	\$28822K	+19%
GMRSD Total Enrollment	838	858	898	856	838	0%
GMRSD Overall PPE	\$28,787	\$30,807	\$30,597	\$32,322	\$34,394	+19%

Table A1. Full budget summary. K = thousands.

Full Regression Output — PVRSD Secondary Combined Model

Variable	Coefficient	Std. Error	t-stat	p-value
Intercept (log scale)	21.69	2.04	10.62	0.001 ***
log(Secondary Enrollment)	-2.08	0.37	-5.60	0.001 ***
n = 5 (PVRSD only)	R ² = 0.913	Adj. R ² = 0.884	F = 31.3	

Table A2. PVRSD secondary combined regression output. This model uses only PVRSD data (n=5) and requires no district fixed effect.