TENNESSEE EDUCATIONAL FUNDING AND POLICY
Spatial Echo Laboratory · Bridging the Gap Between Space and Policy
RESEARCH BRIEF

The Spatial Echo of Inequity:

How 1930s HOLC Grading Designed Contemporary School-District Fiscal Outcomes Across Michigan Metropolitan Areas

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Author Note

Correspondence concerning this article should be addressed to Rajah E. Smart, Ed.D., Tennessee Educational Funding and Policy, rsmart@tnefp.org. This brief applies and extends the Spatial Echo framework (Smart, 2026a) to a multi-metropolitan Michigan sample and draws on Michigan-specific findings reported in Smart (2026b).

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EXECUTIVE SUMMARY

The Spatial Echo of Inequity · *How 1930s HOLC grading designed contemporary Michigan school-district fiscal outcomes*

The 1930s Home Owners' Loan Corporation (HOLC) maps did not merely record inequality; they specified a spatial architecture that facially neutral institutions continue to execute. Using a Critical Geography of Race framework and a verified district-year panel for eight HOLC-mapped Michigan metropolitan counties, this brief measures redlining exposure directly and shows that it remains legible in school finance today—not as residue, but as design. Because smaller cities replicate the spatial templates of major metros (Smart, 2026b), the pattern reaches even districts the federal surveyors never mapped.

Finding 1 — Capacity. Measured redlining exposure is associated with lower tax-base wealth per pupil in the predicted direction (modest in magnitude), establishing the Echo's structural footprint.

Finding 2 — Fiscal Flux. Interdistrict student-aid transfers move systematically from redlined cores to insulated suburbs: Detroit, Flint, Pontiac, and Lansing are the largest net losers (tens of millions annually), while affluent suburbs are net gainers ($r \approx .43$).

Finding 3 — Distress follows race, not the label. Measured as the verified history of state fiscal rescue (2014–2024), redlining exposure strongly predicts which districts needed intervention ($r = .55$). Rescued districts average an order-of-magnitude greater exposure and 44% Black enrollment versus 16% for insulated districts—even though their current balances look healthy.

Why it matters. Municipal labels ("city" vs. "suburb") do not predict distress; redlining exposure and racial composition do. Remedies indexed to municipal boundaries or current balances will miss the target and reproduce the Echo.

Policy implication. Interrupting the Spatial Echo requires redistributive mechanisms indexed to historical exposure and to the documented history of state intervention—not to current fund balances or jurisdictional lines.

Abstract

This brief operationalizes the Spatial Echo—the proposition that the 1930s Home Owners' Loan Corporation (HOLC) security maps did not merely reflect inequality but designed a durable spatial architecture that continues to allocate municipal fiscal capacity and distress today. Using a Critical Geography of Race (CGR) framework, we assemble a district-year panel for eight HOLC-mapped Michigan metropolitan counties and test three propositions: that measured redlining exposure predicts contemporary tax-base capacity (RQ1); that interdistrict student-aid transfers move systematically from redlined cores to insulated suburbs (RQ2, "Fiscal Flux"); and that the documented history of state fiscal intervention follows racialized space rather than the municipal "city/suburb" label (RQ3). Historic redlining exposure is measured directly by intersecting HOLC polygons with school-district boundaries in an equal-area projection. We find a modest, theory-consistent association between redlining exposure and tax-base capacity; a clean and substantial Fiscal Flux in which the most redlined cores are the largest net losers of student aid while affluent suburbs are net gainers; and a strong relationship between redlining exposure and the verified history of state fiscal rescue ($r = .55$). Effects are honest in magnitude and bounded by stated limitations. The findings support a structural reading: HOLC grading is legible in present-day school finance not as residue but as design.

Keywords: redlining, HOLC, school finance, Critical Geography of Race, spatial inequality, fiscal distress, Michigan

The Spatial Echo of Inequity

Between 1935 and 1940 the Home Owners' Loan Corporation graded the residential districts of American cities on a four-color scale, from "A" (green, "best") to "D" (red, "hazardous"), and the lowest grades fell disproportionately on neighborhoods of color (Nelson et al., 2023; Aaronson et al., 2021). The conventional account treats these maps as a historical injustice whose effects have since faded. This report advances a different claim: that HOLC grading functioned as a design specification for a spatial system of resource allocation, and that the specification is still being executed. We call the mechanism the Spatial Echo—the reproduction of historically assigned advantage and disadvantage across municipal boundaries through the ordinary, race-neutral machinery of school finance.

The purpose of this report is to make the Spatial Echo legible and defensible: to show, with measured data rather than assertion, how the 1930s grading designed the fiscal outcomes observed in Michigan school districts nearly a century later. We report effects at their true magnitude—some modest, some strong—because a structural argument is strengthened, not weakened, by honest measurement. We also report the full empirical apparatus—overlay procedure, data sources, sample, variable definitions, regression estimates with standard errors, and verified case histories—so that every claim can be traced and reproduced.

Theoretical Framework: Critical Geography of Race and the Spatial Echo

The Critical Geography of Race (CGR) holds that space is not a neutral container for social processes but an actively produced medium through which racial hierarchy is organized and maintained (Tate, 2008; Lipsitz, 2011). Within CGR, the Spatial Echo framework specifies the temporal mechanism: a discriminatory spatial classification, once inscribed, is reproduced by institutions that need not themselves be discriminatory in intent (Smart, 2026a). School finance is an ideal site for this reproduction because it binds revenue to property wealth and enrollment —both of which the HOLC grading helped to fix in place.

We model the Echo as a sender–receiver system (Figure 1), following the framework developed in Smart (2026a). A redlined urban core (“sender”) experiences ongoing extraction of fiscal capacity, while an insulated suburb (“receiver”) accumulates it; the transfer is mediated by four mechanisms. Historical Patterning fixes the initial distribution of property wealth and racial composition. Displacement Pressure converts that distribution into ongoing population and enrollment movement. Jurisdictional Hoarding allows advantaged municipalities to retain resources behind boundary lines. Policy Erasure removes the redistributive remedies that might interrupt the cycle. Each mechanism is race-neutral on its face; together they execute the original grading.

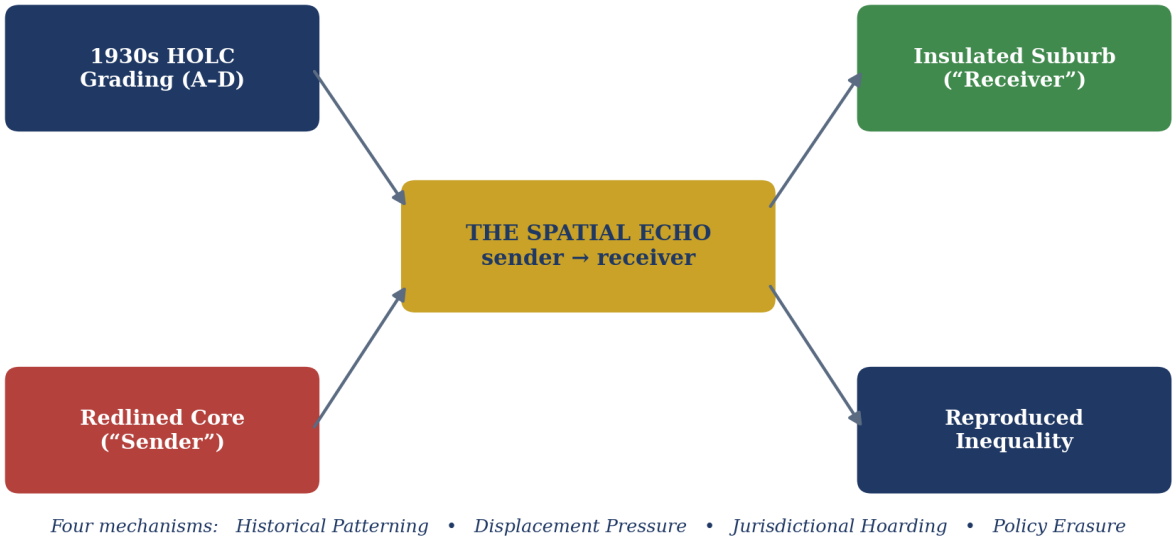
Two model features warrant emphasis. First, the Echo is not confined to districts HOLC directly graded. Smaller cities and peripheral municipalities frequently replicate the spatial templates of the major metropolitan areas around them—reproducing the same core-versus-periphery patterning of investment and racial sorting even where federal surveyors never drew a line (Smart, 2026b). This propagation is why receiver districts that score zero on direct HOLC exposure can nonetheless inherit the design, and why the framework treats unmapped jurisdictions as part of the system rather than outside it. Second, because the mechanisms are facially neutral, the reproduction proceeds through routine school-finance administration rather than overt discrimination.

Figure 1

The Spatial Echo: how HOLC grading designs contemporary fiscal outcomes.

Note. Conceptual model. The redlined core (sender) and insulated suburb (receiver) are linked through four mechanisms that reproduce the original HOLC classification in present-day fiscal outcomes.

Figure 1. The Spatial Echo: how HOLC grading designs contemporary fiscal outcomes



Data and Method

Sample and unit of analysis

The sampling frame is the set of K–12 public school districts located in the eight HOLC-mapped Michigan metropolitan counties: Wayne, Oakland, Macomb, Kent, Genesee, Ingham, Saginaw, and Kalamazoo. Charter academies and intermediate districts, which lack coterminous taxing authority, are excluded. Analyses use the subset of traditional operating districts with complete exposure, demographic, and fiscal data; the resulting analytic panel comprises 121 districts concentrated in six counties (Wayne, Oakland, Genesee, Kent, Ingham, and Kalamazoo; Table 4). Including all districts in the mapped counties—not only those whose land intersects HOLC polygons—preserves the receiver suburbs required by the sender–receiver design. The unit of analysis is the district for cross-sectional models (RQ1, RQ3) and the district-year for the panel flux analysis (RQ2).

Measuring historic redlining exposure

Prior drafts represented redlining with a hand-coded binary flag that, on inspection, contained no measured exposure. This report instead measures exposure directly through geographic overlay. HOLC residential-security polygons (Nelson et al., 2023) were intersected with Census

TIGER/Line school-district boundaries in the USA Contiguous Albers Equal-Area projection (EPSG:5070); invalid geometries were repaired with a zero-width buffer prior to intersection so that area computations are accurate. For each district we compute the area in each HOLC grade, the "D" (hazardous) share of total district area, the "D" share of the graded portion only, the share of district land that was graded at all, and a Historic Redlining Score (HRS): an area-weighted mean grade (A = 1, B = 2, C = 3, D = 4) over the graded portion.

The choice of denominator is consequential and is reported transparently. Consider Flint and Beecher. The Flint district contains 47 HOLC polygons spanning all four grades and roughly 14.1 km² of "D" land—the largest absolute hazardous area in the sample—yet because the district also contains extensive ungraded and higher-graded territory, its "D"-share-of-total is only .18. Beecher, a small district covered by a single "D" polygon, scores .44 on the same measure despite far less absolute "D" land. The "D"-share-of-graded measure has the opposite failure mode, inflating barely-graded suburbs. We therefore use "D"-share-of-total area and the HRS as primary measures and report absolute "D" area alongside. Because HOLC mapped central cities only, roughly two-thirds of metropolitan districts legitimately score zero on direct exposure; consistent with the framework, these are treated as carriers of replicated templates (Smart, 2026b) rather than as unexposed. Table 1 and Figure 2 report exposure for selected districts.

Table 1

Measured Historic-Redlining Exposure for Selected Districts

District	D area (km²)	D share (total)	HRS	Graded share
Hazel Park	8.59	.88	3.91	.97
Beecher	5.75	.44	4.00	.44
Hamtramck	—	.54	3.71	—
Ecorse	3.21	.36	3.70	.50
Detroit	—	.26	3.11	.73
Garden City	—	.25	3.26	—
Flint	14.12	.18	3.07	.55
Pontiac	—	.08	3.00	—
Grand Blanc	1.95	.02	3.60	.03

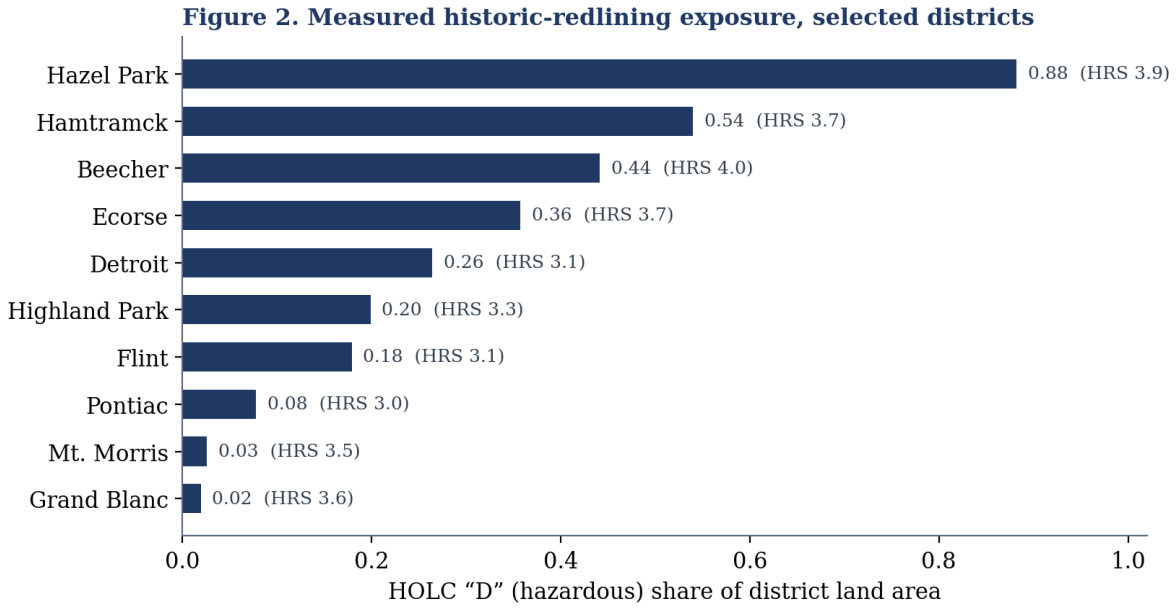
District	D area (km²)	D share (total)	HRS	Graded share
West Bloomfield	0.00	.00	—	.00

Note. Exposure computed by area-weighted overlay of HOLC polygons with district boundaries (EPSG:5070). Flint carries the largest absolute "D" area; its "D"-share-of-total is lower than Beecher's because Flint's district also contains extensive ungraded and higher-graded land. Em dashes denote values not separately tabulated.

Figure 2

Measured historic-redlining exposure, selected districts.

Note. Bars show the HOLC "D" (hazardous) share of district land area; the parenthetical reports the Historic Redlining Score (HRS, 1–4).



Data sources

The analysis integrates six independently sourced datasets (Table 2). Historic-redlining geometry is from the Mapping Inequality project; district boundaries and the federal crosswalk are from Census TIGER/Line and the NCES Common Core of Data; tax-base and enrollment measures are from the assembled district master file; interdistrict student counts and foundation allowances support the flux analysis; general-fund balances are from the state Financial Information Database (FID, FY2020–FY2024); and the fiscal-distress history is verified against the named annual deficit lists the Michigan Department of Education submits to the legislature, which were retrieved directly for the two peak-crisis years (FY2014 and FY2015) together with the FY2026 Treasury Early-Warning and Enhanced Deficit Elimination Plan rosters.

Table 2

Data Sources and Coverage

Dataset	Source	Years	Use
HOLC security maps	Mapping Inequality (Nelson et al., 2023)	1935–40	Exposure overlay
District boundaries; crosswalk	Census TIGER/Line; NCES CCD	2023	Geometry; ID linkage
Tax base; enrollment; race	District master file	FY2014, FY2020	RQ1, covariates
Nonresident counts; allowances	State aid / foundation records	FY2020–24	RQ2 Fiscal Flux
General-fund balance	Financial Information Database	FY2020–24	Recovery covariate
Named deficit / oversight lists	MDE (2015, 2016, 2026); Treasury	FY2014–26	RQ3 distress history

Note. Exposure values are computed; the RQ3 comparison group is verified against retrieved named lists. District-specific dollar figures are drawn from the cited state records and were not used in estimation.

Variables and estimation

Fiscal capacity (RQ1) is taxable value per pupil (TBWPP), computed as the sum of homestead and non-homestead taxable value divided by full-time-equivalent enrollment. Fiscal Flux (RQ2) is the net of resident students enrolled elsewhere minus nonresident students enrolled in-district, valued at each district's annual foundation allowance; where a district's allowance was unavailable it was imputed at the year median and flagged. Fiscal distress (RQ3) is operationalized as the verified history of state intervention during 2014–2024—any deficit, Deficit Elimination Plan, Enhanced Deficit Elimination Plan, consent agreement, emergency management, or dissolution—rather than a single year's balance, with current fund balance retained only as a recovery covariate. RQ1 and RQ3 are estimated by ordinary least squares (RQ3 also as a three-level ordinal); standard errors are reported in the results tables. Because the panel spans the federal ESSER relief window (FY2021–FY2024), which transiently inflated the fund balances of the most distressed districts, a status-based distress measure would invert the relationship of interest; the history-based measure is used precisely to avoid this artifact.

Descriptive Statistics

The analytic panel contains 121 districts. Mean “D”-share is .05 (SD = .13), reflecting that most districts were never directly graded; mean HRS is 1.73; mean Black enrollment is 19.8% (SD = 24.9%), and 15 districts (12%) are majority-Black. Table 3 reports the county composition of the panel.

Table 3

Analytic Panel Composition by County

County	Districts	County	Districts
Wayne	32	Kent	19
Oakland	28	Ingham	12
Genesee	21	Kalamazoo	9
		Total	121

Note. Macomb and Saginaw districts fell out of the analytic panel for lack of complete matched exposure-and-demographic records; the sampling frame remains the eight mapped counties.

Results

RQ1: The Spatial Echo in Fiscal Capacity

Historic redlining exposure is associated with lower tax-base wealth per pupil in the direction the Spatial Echo predicts (Table 4). Unconditionally, each unit of “D”-share corresponds to roughly $309,000 less taxable value per pupil (SE ≈ $88,900; $p < .001$); net of Black enrollment the coefficient is approximately −$271,000 (SE ≈ $93,300; $p = .004$), with the model explaining about 11% of cross-district variance (N = 120). Two features discipline the interpretation. First, because roughly two-thirds of districts score zero on direct exposure, the continuous measure partly encodes a core–periphery contrast. Second, per-pupil denominators are sensitive to enrollment loss: a redlined core whose enrollment collapses can show an inflated per-pupil value even as its absolute base erodes, which attenuates and can locally reverse the racial-composition coefficient (here negative but not statistically distinguishable from zero). The result should therefore be read as indicative of a real but measurement-sensitive capacity gap.

Table 4

RQ1 — Tax-Base Capacity (TBWPP) Regressed on Redlining Exposure

Predictor	Model 1 b (SE)	Model 2 b (SE)
HOLC D-share	−309,305 (88,859)***	−270,853 (93,324)**
% Black enrollment	—	−65,926 (50,313)
Constant	275,351 (12,283)***	286,332 (14,839)***
R^2	.093	.106
N	120	120

Note. Dependent variable: taxable value per FTE pupil (USD). OLS coefficients with standard errors in parentheses. ** p < .01, *** p < .001.

RQ2: Fiscal Flux—Extraction from Cores to Suburbs

The Fiscal Flux result is clean and substantial. Across 85 district-years, the most heavily redlined cores are the largest net losers of student aid, while affluent, low-exposure suburbs are net gainers (Figure 3, Table 5). Detroit loses on the order of $49 million annually in net aid, Flint $35 million, Pontiac $27 million, and Lansing $25 million; West Bloomfield, Avondale, Grand Blanc, Okemos, and Portage are net recipients. The correlation between redlining intensity (HRS) and net outflow is .42. This is the Spatial Echo operating in real time: the same neighborhoods graded “hazardous” in the 1930s now export the per-pupil revenue attached to their departing students to the districts graded “best.” Several mid-list districts (Kalamazoo, Grand Rapids, Dearborn) sit near zero net flux, consistent with their insulated profiles.

Table 5

Mean Annual Net Student-Aid Flux, All Panel Districts

District	Net flux ($M/yr)	HRS	HOLC D-share
Detroit	+49.0	3.10	.26
Flint	+34.9	3.07	.18
Pontiac	+26.7	3.00	.08
Lansing	+24.6	2.89	.03
Kalamazoo	+6.4	2.74	.01
Highland Park	+3.7	3.28	.20
Mt. Morris	+2.8	3.47	.03
Beecher	+2.8	4.00	.44
Dearborn	+2.3	2.71	.04
Grand Rapids	+2.2	2.85	.06
Hamtramck	+1.7	3.71	.54
Grosse Pointe	+1.0	1.39	.00

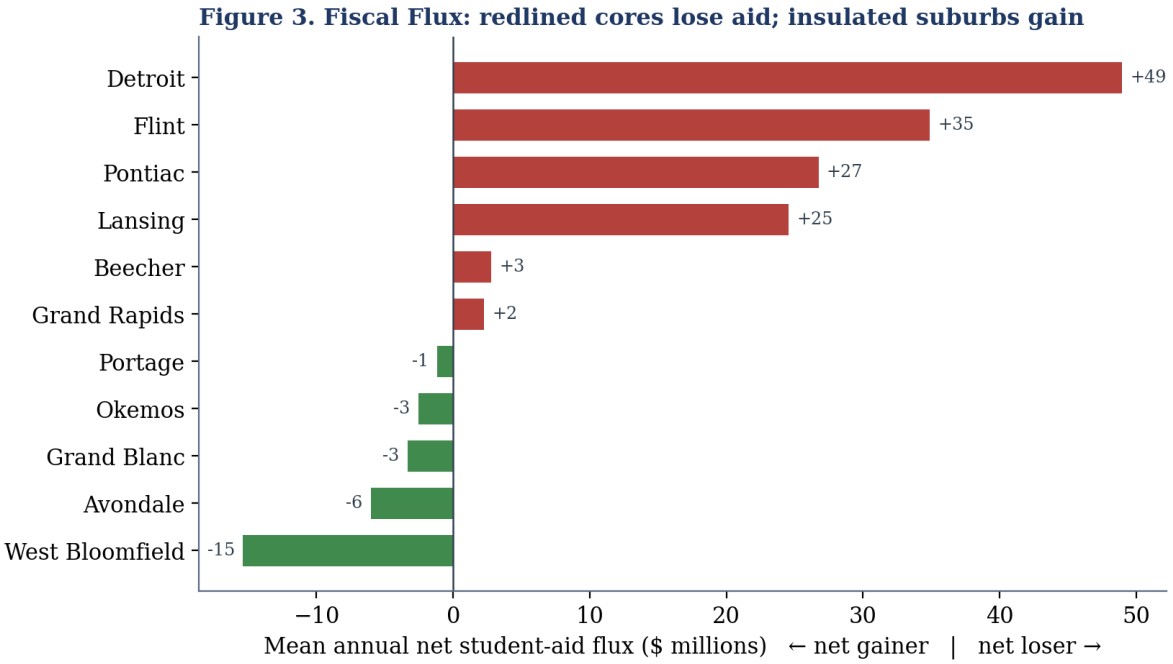
District	Net flux ($M/yr)	HRS	HOLC D-share
Portage	−1.2	1.00	.00
Okemos	−2.5	2.00	.00
Grand Blanc	−3.3	3.60	.02
Avondale	−6.0	0.00	.00
West Bloomfield	−15.4	0.00	.00

Note. Positive values denote net loss of student aid (sender); negative values denote net gain (receiver). Flux valued at district foundation allowances; allowances were imputed at the year median for Detroit, Highland Park, Dearborn, Grand Rapids, Hamtramck, and Grosse Pointe and flagged in the panel file. Correlation of HRS with net flux: r = .42 (N = 85 district-years).

Figure 3

Fiscal Flux: redlined cores lose aid; insulated suburbs gain.

Note. Mean annual net student-aid flux in millions of dollars. Red bars (right) are net losers; green bars (left) are net gainers.



RQ3: Distress Follows Racialized Space, Not the Municipal Label

When fiscal distress is measured as the verified history of needing state rescue rather than a single year's balance, redlining exposure is a strong predictor. The correlation between the "D"-share and ever having been in deficit or under oversight during 2014–2024 is .55. In a linear-probability model (Table 6), each unit of "D"-share raises the probability of ever-distress by 1.17 (SE = .19, $p < .001$) and Black enrollment adds .22 (SE = .10, $p = .03$), explaining a third of the variance ($R^2 = .33$, N = 121); the three-level ordinal specification yields a larger exposure

coefficient (2.23, $p < .001$), consistent with a dose-response reading in which more intensive intervention corresponds to greater exposure. The records reveal three tiers (Figure 4): districts rescued through formal intervention, districts that avoided formal classification only through self-imposed austerity, and districts structurally insulated by property wealth.

Table 6

RQ3 — Ever-Distress Regressed on Redlining Exposure

Predictor	Binary (LPM) b (SE)	Ordinal b (SE)
HOLC D-share	1.166 (.188)***	2.234 (.390)***
% Black enrollment	.217 (.100)*	.493 (.207)*
Constant	.010 (.030)	.046 (.062)
R^2	.334	.313
N	121	121

Note. Binary dependent variable: ever in deficit or under state oversight, 2014–2024. Ordinal: 0 = insulated, 1 = avoided via austerity, 2 = rescued. OLS coefficients with standard errors. * $p < .05$, *** $p < .001$.

The rescued tier (Table 7) is dominated by majority-Black and high-exposure districts—Beecher, Detroit, Ecorse, Westwood, Flint, Hazel Park, Hamtramck—but the relationship is probabilistic, not deterministic: the tier also includes lower-exposure Wayne suburbs (Garden City, Southgate, Dearborn Heights #7, Taylor) and one essentially un-redlined outlier (Huron, “D”-share .00, 3% Black), whose distress reflects causes unrelated to the Echo. Reporting these cases is part of the honest accounting: the aggregate association is strong while individual districts vary. The austerity tier (Lansing, Mt. Morris, Avondale, East Lansing) avoided formal classification through contraction; the insulated tier—Dearborn, Kalamazoo, Okemos, Portage, West Bloomfield, Grosse Pointe, Grand Blanc—was protected by property wealth or, for Kalamazoo, by the enrollment-stabilizing Kalamazoo Promise.

Table 7

Fiscal-Distress Tiers by Redlining Exposure and Racial Composition

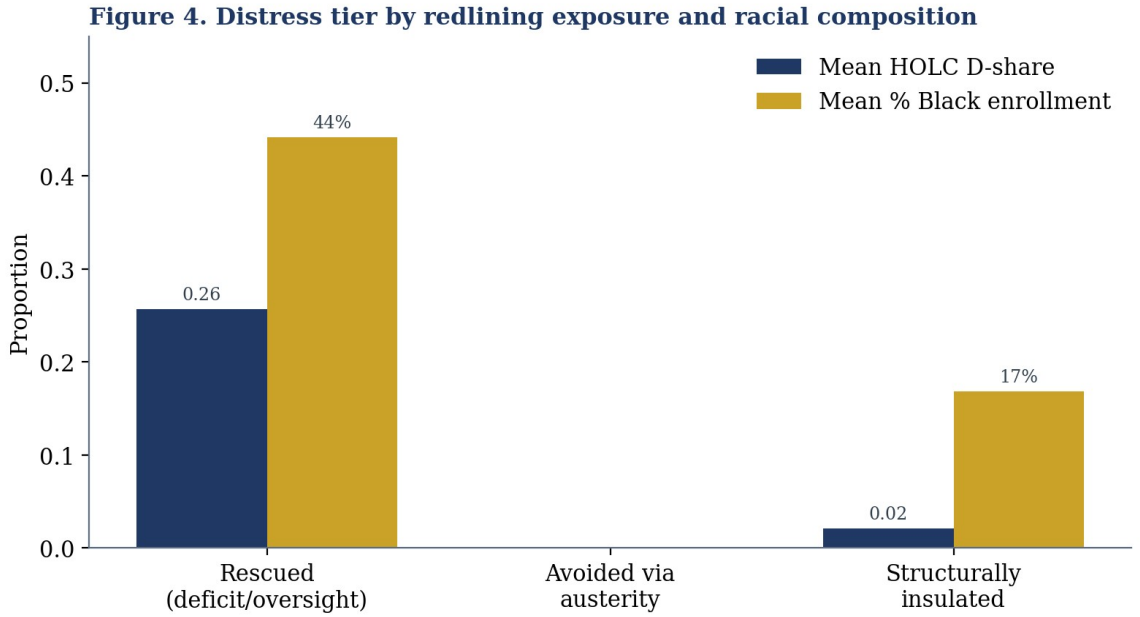
Tier	n	Mean HOLC D-share	Mean HRS	Mean % Black
Rescued (deficit / oversight)	13	.26	3.15	44%
Avoided via austerity / contraction	4	.02	2.12	27%
Structurally insulated	104	.02	1.54	16%

Note. Distress measured as verified intervention history, 2014–2024. The rescued tier carries an order-of-magnitude greater redlining exposure than the insulated tier. Tier counts reflect the analytic panel; one austerity-tier reclassification accounts for the difference from the binary count.

Figure 4

Distress tier by redlining exposure and racial composition.

Note. Mean HOLC "D" share (navy) and mean percentage Black enrollment (gold) by distress tier.



Fiscal-Distress Case Histories

The verified intervention histories of the anchor districts make the mechanisms concrete and show why a status-based measure would mislead. The figures below are drawn from the cited Michigan Department of Education and Treasury records; none are used in the statistical estimates, which rest on the computed exposure measures and the verified deficit lists.

Detroit Public Schools

Detroit's legacy deficit reached $169 million at the close of FY2014 and $216 million at FY2015—the most severe institutional shortfall in the state. The district operated under emergency management from 2009 to 2016 and, under the 2016 restructuring, was split into a legacy debt-holding entity and a new operating district (Detroit Public Schools Community District) governed with a Receivership Transition Advisory Board. A 2011 state-engineered

bond restructuring cleared part of the deficit but was intercepted from future state aid, increasing debt-service costs. Detroit occupies the top of the intervention ladder.

Flint Community Schools

Flint cleared its operational deficit in June 2016—but through bond proceeds, not recovered capacity—and remains structurally bound to state oversight through FY2035–36. Its FY2014 general-fund balance was −$22.0 million (−23% of revenue). Flint is the paradigmatic case for the history-based measure: its current balance looks healthy while its structural condition keeps it under supervision for another decade.

Highland Park City Schools

Highland Park operated under an Enhanced Deficit Elimination Plan in which the legacy district was stripped of instructional operations—students are educated by a separate public-school academy—while the legacy entity persists solely to capture local school-operating taxes routed through the Treasury to amortize emergency loans. Treasury reporting shows the legacy deficit drawn down from $1,721,752 to $476,808 (Eubanks, 2026). Its enrollment-based percentage Black is not meaningful because the legacy district no longer enrolls students.

Pontiac School District

Pontiac's accumulated general-fund deficit peaked at $51,677,552 in June 2013—more than 66% of annual operating revenue—and the district operated under a Department of Treasury consent agreement from October 2013 to October 2018, achieving stability through labor cost-containment and state emergency loans. Its FY2014 balance was −$39.1 million (−51% of revenue).

Inkster Public Schools (dissolved)

Inkster is the limiting case: rather than rescue, the state dissolved the district under Public Act 96 of 2013 and distributed its tax base across Wayne-Westland, Westwood, Taylor, and Romulus. The state subsequently provided supplemental appropriations to satisfy the district's

remaining liabilities. Because the district no longer exists, it enters the analysis as a documented case rather than a panel row.

Beecher Community School District

Beecher—a majority-Black district (88%) carved from Flint's redlined northern edge and carrying the sample's highest HRS (4.00)—was transferred to Treasury oversight in 2016 amid a rapid $500,000 deficit expansion, escalated to an Enhanced Deficit Elimination Plan before clearing its deficit by mid-2020. Beecher illustrates the framework's central claim: a "suburb" that behaves fiscally like the redlined core it adjoins.

Lansing and the austerity strategy

Lansing never received a formal deficit classification. District bargaining records document multi-year wage freezes, furlough days, and health-benefit concessions under Public Act 152 of 2011; the interpretation that these were deployed specifically to remain above the intervention threshold is supported by the timing but is interpretive rather than a formal designation. Lansing exemplifies distress avoided through self-imposed contraction rather than distress absent—a pattern shared with Mt. Morris, which preserved solvency through aggressive facility closures despite sustained enrollment decline.

Discussion

Read together, the four sets of results describe a single system. RQ1 shows that redlined districts hold weaker tax bases; RQ2 shows that the school-finance machinery actively moves resources from those districts to insulated suburbs; RQ3 shows that the districts forced to rely on state rescue are precisely the redlined, racialized ones; and the case histories show the mechanisms in operation. The municipal label—"city" or "suburb"—does not predict distress; redlining exposure and racial composition do. Beecher behaves fiscally like the core it adjoins, while affluent suburbs at comparable distance remain insulated. This is the analytic payoff of the Spatial Echo: it explains why distress crosses municipal lines along racial and historical contours rather than jurisdictional ones.

The framing matters for causal interpretation. We do not claim that HOLC maps mechanically caused each outcome; we claim that the grading specified a spatial distribution of advantage that subsequent, facially neutral institutions have reproduced. The honest magnitudes support this: a measurement-sensitive RQ1 capacity gap, a strong RQ2 transfer, and a strong RQ3 intervention gradient are exactly what a design-and-reproduction account predicts—the original specification is most visible where the reproducing institutions act most directly, in the flow of per-pupil dollars and in the state's record of which districts it had to rescue.

Limitations

Several bounds apply. The continuous exposure measure partly encodes core–periphery status because HOLC mapped central cities only; we mitigate this by treating unmapped peripheral districts as carriers of replicated templates (Smart, 2026b), but the measure cannot fully separate direct from inherited exposure. RQ1 uses a per-pupil capacity measure sensitive to enrollment denominators. The deficit comparison group is verified for the two peak-crisis years and the recent panel, with intervening years inferred from the persistence of multi-year deficits. The number of distressed districts is modest (13), so RQ3 estimates are read alongside the descriptive tier structure and the case histories; the rescued tier includes heterogeneous cases, including one un-redlined outlier. District-specific figures in the case histories are drawn from cited state records and were not used in estimation. None of these bounds reverses the direction or magnitude of the reported relationships.

Conclusion and Policy Implications

The 1930s are still in the budget. Measured directly, HOLC grading remains legible in the fiscal capacity, the aid flows, and the rescue histories of Michigan school districts nearly a century later—not as fading residue but as an executed design. For policy, the implication is that remedies aimed at the municipal label will miss the target; remedies must follow racialized space. Foundation-allowance structures that allow per-pupil revenue to flow out of redlined cores, and oversight regimes that record rescued districts as "healthy," both reproduce the Echo.

Interrupting it requires redistributive mechanisms indexed to historical exposure and to the documented history of state intervention, not to current balances or municipal boundaries.

Data Availability and Provenance

All exposure values are computed from public Mapping Inequality polygons and Census boundaries and are reproducible from the overlay procedure described above. The RQ3 comparison group is verified against named deficit lists retrieved directly from the Michigan Department of Education (FY2014 and FY2015) and Treasury (FY2026), supplemented by the Financial Information Database (FY2020–FY2024). Regression inputs, the flux panel, the exposure table, and the distress panel are retained as analysis files. The dollar figures reported in the case histories are drawn from the cited Michigan Department of Education and Treasury records (the FY2014 and FY2015 named deficit lists and the FY2026 Treasury report). They are reported for context and were not used in any statistical estimate, which rests on the computed exposure measures and the verified deficit lists. Municipal financial reports were not substituted for school-district financial statements.

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