RESEARCH ON THE FLORIDA EDUCATION FINANCE PROGRAM

THE FLORIDA PRICE LEVEL INDEX, THE SPARSITY SUPPLEMENT, AND DISCRETIONARY MILLAGE

Senior Research Economist – James F. Dewey
Economic Analysis Program

Professor and Program Director – David Denslow
Economic Analysis Program

Research Coordinator – Babak Lotfinia
Economic Analysis Program

Research Assistants
Eric Breitenstein
Jaclyn Cahan
Hillary Hussin
Ian Unger

Bureau of Economic and Business Research
Warrington College of Business Administration
University of Florida

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Summary and Recommendations

In this report, we consider the accuracy and appropriateness of several aspects of the Florida Education Finance Program (FEFP) – the Florida Price Level Index (FPLI), the Sparsity Adjustment, and Discretionary Millage.

The FPLI is the basis of the FEFP's personnel cost adjustment, the District Cost Differential (DCD). We find that FPLI as it stands is a very good measure of variation in the costs of goods and services across counties. We see no immediately feasible way to improve it in that respect. However, the current version of the FPLI suffers a serious problem when used as the basis of a personnel cost adjustment—it ignores the role of amenities. Amenities are important because, if a location is more desirable as a place to live, "compensating differentials" will develop in housing and labor markets. In the housing market, prices will be driven up by higher demand to live in the area, while in the labor market, people will willingly work for less, since the desirability of the location itself provides compensation. We develop an amenity-adjusted, statistically- and geographically-smoothed version of the FPLI, denoted FPLI_AS, in order to avoid this problem. FPLI_AS exhibits far less spatial variation than does the current version of the FPLI, and its level of variation is less likely to trend up significantly over time. Since a DCD is clearly required on both theoretical and empirical grounds to achieve the mandated equality of educational resources across districts, we recommend switching to the FPLI_AS.

In our investigation of the sparsity supplement, we find that the existing sparsity supplement far overestimates the adjustment needed to maintain an equalized base level of per student educational resources across districts. While the theoretical case that smaller districts may have higher per pupil costs is clear, it offers no guidance as to whether differences in costs apply to many schools, or only the smallest few, or whether it is substantial or quite small. Empirical evidence is mixed as to whether actual cost differences rise to the level of economic or statistical significance for districts as large as Florida's. Furthermore, it is not theoretically clear that such differences, if they exist, require any adjustment, since small districts could consolidate entirely, or could consolidate only certain functions, if they thought there truly were gains to increased size. If such a supplement is needed, however, evidence is clear that the current supplement is far too large. Additionally, if a sparsity supplement is needed, and if there is a reason to have discretionary millage, the sparsity supplement should not be offset by the wealth adjustment, which has the effect of reducing the ability to provide local discretionary funding beyond the base level of resources dictated by the FEFP, but only for sparse districts.

We find there are a number of advantages to allowing some level of unequalized discretionary millage. It provides a direct incentive for schools to excel; it allows parents who would like to spend more on their children's education than the state provides some opportunity to do so through the public schools, and it encourages efficiency in housing markets by allowing communities more flexibility to be what their residents desire, thus increasing the Florida's tax base. While it increases intrastate funding variation, it increases state average funding and therefore reduces national funding inequality. The major remaining question is how much discretion the school board should have without turning to the electorate, and if – and to what extent – discretionary effort should be equalized for districts with a lower per student tax base.

Based on our findings, we make four main recommendations:

1) Switch to an amenity adjusted and statistically and geographically smoothed version of the FPLI, denoted FPLI_AS, as the basis of the DCD, to be calculated as described in this report;
2) Either drop the sparsity supplement entirely, after which small districts may merge with other districts at their discretion if they believe there truly is an advantage to being larger, or, scale it back greatly and base it on a thorough and modern econometric study of scale economies in Florida's schools;
3) Drop the wealth adjustment to the sparsity calculation immediately if the sparsity supplement is retained; and
4) Allow unequalized discretionary millage to be increased until a district's funding equals the national average per FTE. If this is infeasible, retain at least the current level of discretionary millage, unlinked from the sparsity supplement, and consider increasing the unequalized cap as much as possible.

1. Introduction

In this report we consider several aspects of the Florida Education Finance Program (FEFP). The largest portion of the report is devoted to careful consideration of the Florida Price Level Index (FPLI), the basis of the District Cost Differential (DCD). The Bureau of Economic and Business Research (BEBR) since 1995 has engaged in research on improving the FPLI, and on generating alternatives to the current version of it. The report also considers the sparsity supplement and the role of local discretionary millage.

Given that the portions of the FEFP affected directly by the DCD and the sparsity supplement are designed to adjust for cost differences, and thus, provide an equal level of funding across districts, these sections are focused on accurately measuring cost differences to ensure equitable funding. Discretionary local effort, on the other hand, pertains to a funding source that has been less than fully equalized. Thus, one would expect this discussion to pertain more to the inherent tradeoffs between efficiency and equity, since the two goals tend to be somewhat at odds with each other. That turns out to be true in some respects, but false in one important respect: allowing more unequalized local discretion, while increasing intrastate funding variation, improves national equity while also improving Florida's internal efficiency.

The report is organized as follows. Section 2 presents background information on the role of the DCD and the current sparsity supplement in the FEFP. Section 3 presents an exhaustive consideration of the current version of the FPLI and suggests improvements to it. Section 4 considers the sparsity supplement in detail. Section 5 briefly considers the joint effect of our recommendations on the FPLI and sparsity. Section 6 considers discretionary millage, and Section 7 concludes this report.

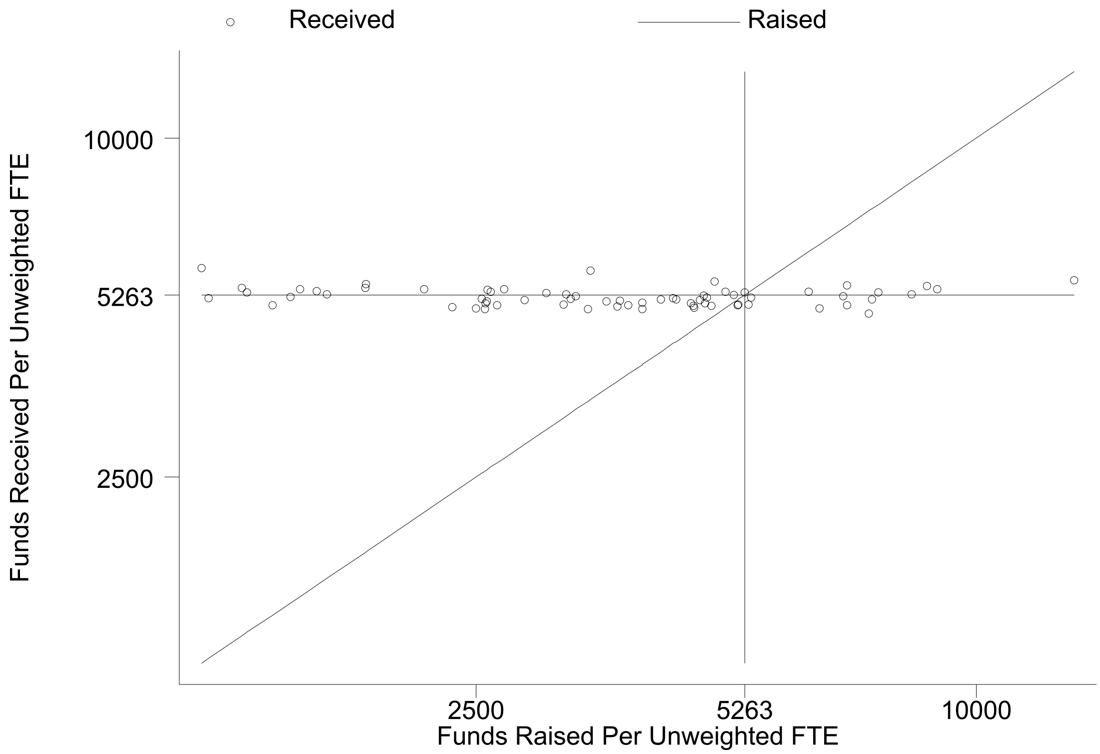
2. Background: The Role of the District Cost Differential and the Sparsity Supplement in the Florida Education Finance Program

The Florida Education Finance Program (FEFP) is designed to provide an equal base level of educational resources across the school districts of Florida. It does so primarily by redistributing funds from counties with a high tax base per student to counties with a low tax base per student. It also adjusts for differences in costs attributed to program factors (for example exceptional and special education students), sparsity, and personnel costs. The district cost differential (DCD) is the basis for the personnel cost adjustment, the rationale for which is that the same underlying economic factors causing the tax base per student to vary across districts will also cause wage and salary costs to differ across districts. If a county has resources or an industry mix that make it more productive, wages and housing costs will be driven up. If there are more rich people, they will demand more land, driving up housing costs and quite possibly the wages of similarly qualified workers. Thus, the FEFP without a DCD would arbitrarily take account of one manifestation of the differences in economic factors across counties while ignoring others. The theoretical rationale for the sparsity supplement is that there may be economies of scale in school and district size, meaning that smaller schools may need more funding per student, all else equal, to provide a uniform quality of education.

The theoretical case for the DCD is clear, given the goal of equalization of base funding. Asking whether there is a need for a DCD is like asking whether there is a need to account for program cost factors. (Of course, Florida might decide that both program cost factors and the DCD are more trouble than they are worth, and choose to go with a system that is equalized in nominal resources per unweighted student rather than in real resources per weighted student). The justification for the sparsity supplement is much weaker, since, if costs were higher in small schools or districts, the more sensible solution would be to reduce costs through consolidation. McMahon (1994) argues against sparsity type adjustments, since they create disincentives for schools and districts to consolidate, when such consolidation would reduce costs.

The DCD, the sparsity supplement, and program cost factors are indeed a *very* small portion of the overall redistribution in the FEFP. To see this, let us think of the FEFP in stages. First, money is raised by taxing property and sales, with more money raised in counties with more property value or higher taxable sales. In 2003-2004, this corresponded to $5,263 per un-weighted FTE (UWFTE) (based on the 2003-2004 third calculation and excluding discretionary local effort). This sum could simply be allocated to school districts on a per UWFTE basis. Figure 2.1 plots 2003-2004 funds received per UWFTE against funds raised per UWFTE. Funds raised are required local effort plus the sales tax revenues raised in the county and lottery funds raised in the county, assuming lottery funds are proportional to sales tax revenues. The lab schools are combined with the districts of the counties in which they reside. The horizontal line gives the allocation that would obtain if $5,263 were given out per FTE. The 45° line gives the allocation that would result if every district kept all funds raised in that district. The points represent the actual allocation. From the figure, it is obvious that the major effect of the FEFP is moving from the 45° line to the horizontal line – simple redistribution. The effect of all other adjustments is extremely small relative to the initial redistribution.

Figure 2.1 Redistribution and Cost Factors under the FEFP



Figures 2.2A and 2.2B plot the ratio for each county of its FEFP allocation relative to the funds it contributed to the FEFP on the vertical axis against total funds raised for the FEFP in 2003-2004 (in millions, on a log scale) on the horizontal axis. The ratio of funds allocated to funds raised is a measure of the degree to which a county is subsidized by other counties or taxed to fund other counties. Figure 2.2A contains the plot for counties that raised less than $50 million dollars, and Figure 2.2B contains the plot for the counties that raised more than $50 million. Table 2.1, below, presents the data on which Figures 2.1, 2.2A and 2.2B are based. Nearly all the counties that raised less than $50 million receive more than they contribute to the FEFP; these are small counties that have a relatively low tax base per student. Of the remaining 33 counties, 14 raise more than they receive. Given their sizes, Miami-Dade County is the biggest total recipient from the FEFP, and Orange County is the biggest contributor. Monroe receives the least per dollar

contributed. Liberty County receives the highest degree of subsidization, but small counties are more subject to fluctuation.

The difference in Figure 2.1 between the flat allocation of $5,263 per UWFTE and the actual allocation depends upon the ratio of weighted FTEs (WFTE) to UWFTEs, the DCD, the sparsity supplement, and various categorical program allocations. While the initial computation of the sparsity supplement involves multiplying the base student allocation (BSA) by a sparsity factor and weighted FTEs, this allocation is then adjusted according to available potential discretionary millage. To make the sparsity supplement easier to compare to the other adjustments, we calculate an Adjusted Sparsity Index (ASI), which is the ratio of the sum of base funding (the DCD times the BSA times WFTEs) and the wealth adjusted actual sparsity allocation to base funding. Similarly, we calculate a student resource need index, SRI, equal to the ratio of WFTEs to UWFTEs. (Again, lab schools are combined with the counties in which they are located.) Table 2.2 presents the three indexes, all normalized so that the UWFTE-weighted average is equal to 1. The ranges of the DCD, SRI, and ASI are 0.16, 0.14, and 0.12 respectively.

The sum of base funding and sparsity funding per UWFTE is proportional to the product of these three indexes. Column 8 of Table 2.2 presents this product, which we dub the Education Cost Factor Index (ECFI) normalized to have an UWFTE-weighted average of 1. Since the state's total base funding and sparsity funding per UWFTE is equal to $4,002, the sum of a district's actual base funding and sparsity funding is equal to $4,002 x ECFI. The range of the ECFI is higher than any of its components at 0.22. The highest ten ECFIs include very large districts, such as Miami-Dade, very rich districts such as Collier, and very small and poor districts such as Glades and Liberty, the latter of which has the highest combined cost factor index.

Figure 2.2A Redistribution Under the FEFP

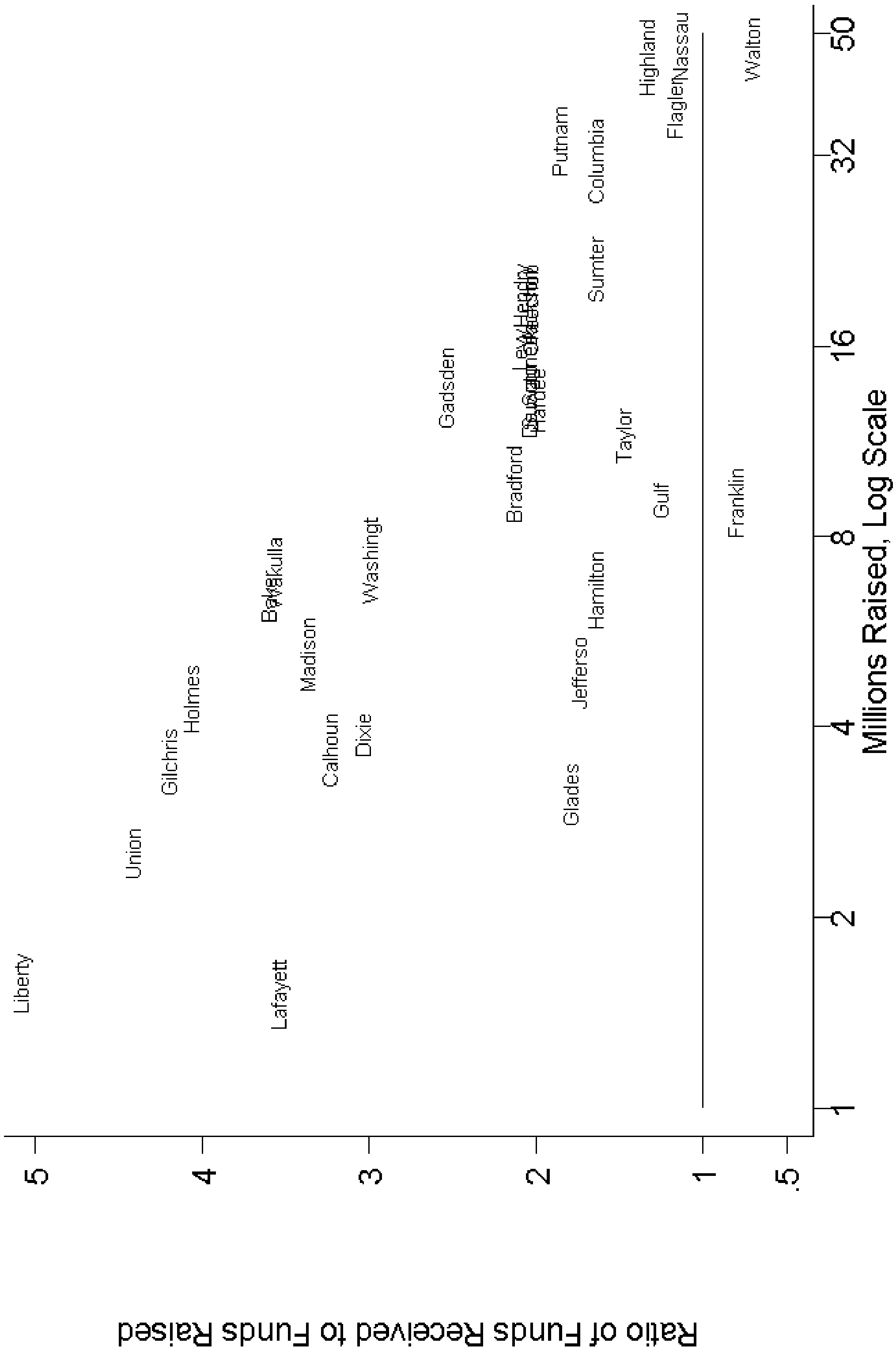


Figure 2.2B Redistribution under the FEFP

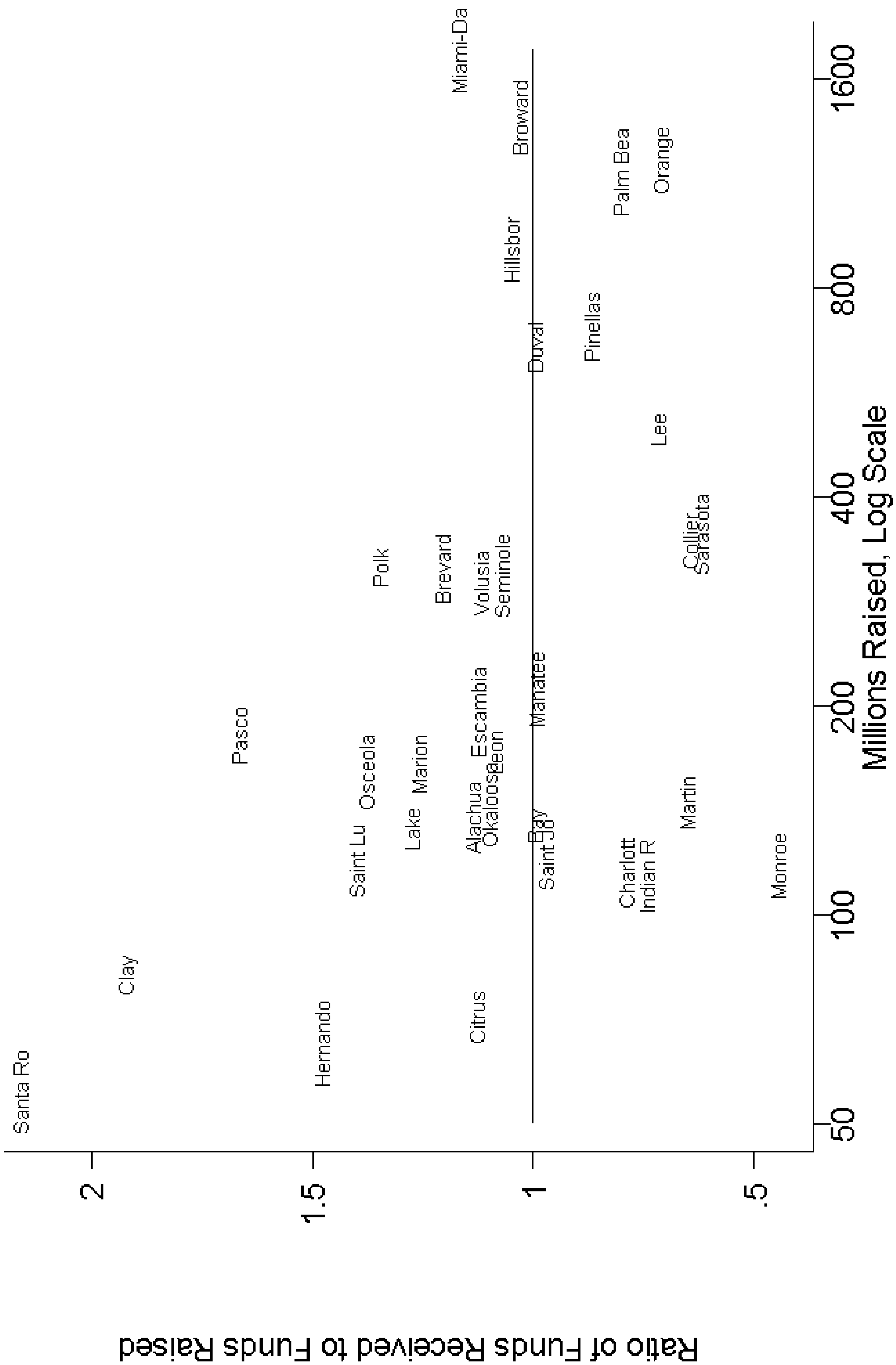


Table 2.1 Redistribution Under the FEFP

County	UWFTE	Funds Raised per UWFTE	Rank	Funds Received per UWFTE	Rank	Difference per UWFTE	Rank	Net Funds from FEFP	Rank
Alachua	29,505	$4,696	24	$5,245	27	$549	42	$16,188,905	24
Baker	4,531	$1,421	63	$5,051	52	$3,630	9	$16,447,544	23
Bay	26,094	$5,158	17	$5,042	56	-$116	52	-$3,022,353	53
Bradford	3,760	$2,581	49	$5,367	14	$2,786	13	$10,476,900	38
Brevard	72,702	$4,351	29	$5,163	39	$811	39	$58,978,850	6
Broward	268,324	$5,266	15	$5,316	20	$50	51	$13,428,532	28
Calhoun	2,222	$1,652	59	$5,272	25	$3,620	10	$8,044,179	40
Charlotte	17,773	$6,477	11	$4,985	62	-$1,492	57	-$26,520,968	58
Citrus	15,350	$4,650	25	$5,147	41	$497	43	$7,623,678	42
Clay	31,016	$2,650	47	$5,045	54	$2,395	22	$74,283,147	4
Collier	39,875	$8,720	3	$5,461	7	-$3,259	65	-$129,964,235	63
Columbia	9,661	$3,250	41	$5,186	35	$1,936	28	$18,699,771	18
Miami-Dade	365,165	$4,839	20	$5,556	4	$717	40	$261,894,828	1
De Soto	5,090	$2,574	50	$5,132	44	$2,558	18	$13,021,615	31
Dixie	2,112	$1,842	57	$5,500	5	$3,658	8	$7,724,828	41
Duval	127,865	$5,174	16	$5,055	50	-$118	53	-$15,115,993	56
Escambia	43,047	$4,565	27	$5,033	58	$468	44	$20,139,555	16
Flagler	8,373	$4,535	28	$5,083	46	$549	41	$4,596,333	45
Franklin	1,310	$6,917	10	$5,236	29	-$1,680	59	-$2,200,793	52
Gadsden	6,369	$2,163	56	$5,386	13	$3,223	12	$20,525,686	15
Gilchrist	2,710	$1,306	65	$5,416	8	$4,110	2	$11,140,651	37
Glades	1,032	$3,036	44	$5,299	22	$2,263	25	$2,335,019	50
Gulf	2,117	$4,318	30	$5,194	33	$876	38	$1,854,613	51
Hamilton	2,000	$3,297	40	$5,237	28	$1,940	27	$3,878,693	47
Hardee	5,160	$2,561	52	$4,967	64	$2,407	21	$12,416,915	33
Hendry	7,576	$2,538	53	$5,181	36	$2,643	17	$20,022,061	17
Hernando	19,247	$3,405	39	$4,963	66	$1,558	30	$29,984,045	11
Highlands	11,567	$3,960	33	$5,101	45	$1,142	35	$13,205,280	30
Hillsborough	178,316	$5,107	18	$5,257	26	$150	50	$26,738,920	14
Holmes	3,345	$1,325	64	$5,318	19	$3,994	4	$13,359,544	29
Indian River	16,308	$6,991	8	$5,047	53	-$1,944	60	-$31,699,408	59
Jackson	6,865	$2,699	46	$5,388	12	$2,689	15	$18,458,482	19
Jefferson	1,421	$3,431	38	$5,817	2	$2,386	23	$3,390,780	49
Lafayette	1,014	$1,493	62	$5,219	30	$3,726	7	$3,778,764	48

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Table 2.1 Redistribution Under the FEFP (Continued)

County	UWFTE	Funds Raised per UWFTE	Rank	Funds Received per UWFTE	Rank	Difference per UWFTE	Rank	Net Funds from FEFP	Rank
Lake	33,669	$3,961	32	$4,965	65	$1,004	36	$33,804,338	10
Lee	65,699	$7,623	5	$5,311	21	-$2,311	61	-$151,864,048	65
Leon	34,338	$4,994	19	$5,325	17	$331	48	$11,372,257	35
Levy	6,077	$2,604	48	$5,329	16	$2,725	14	$16,561,991	22
Liberty	1,353	$1,168	67	$5,879	1	$4,711	1	$6,374,363	43
Madison	3,243	$1,607	60	$5,340	15	$3,733	6	$12,105,730	34
Manatee	39,628	$5,359	13	$5,211	31	-$148	54	-$5,867,309	54
Marion	39,611	$4,172	31	$5,171	38	$999	37	$39,564,752	9
Martin	17,434	$8,357	4	$5,279	24	-$3,078	64	-$53,662,901	60
Monroe	8,984	$13,128	1	$5,595	3	-$7,533	67	-$67,680,553	61
Nassau	10,412	$4,578	26	$4,990	61	$412	46	$4,290,459	46
Okaloosa	30,608	$4,715	23	$5,081	48	$365	47	$11,182,035	36
Okeechobee	7,126	$2,564	51	$5,081	47	$2,517	19	$17,936,091	20
Orange	163,909	$7,492	6	$5,172	37	-$2,320	62	-$380,264,903	67
Osceola	43,511	$3,697	36	$5,023	59	$1,327	33	$57,721,882	7
Palm Beach	168,497	$6,987	9	$5,466	6	-$1,521	58	-$256,323,964	66
Pasco	56,420	$3,209	42	$5,280	23	$2,071	26	$116,855,065	2
Pinellas	112,765	$6,281	12	$5,325	18	-$955	56	-$107,746,069	62
Polk	83,118	$3,808	34	$5,043	55	$1,235	34	$102,675,102	3
Putnam	11,838	$2,857	45	$5,155	40	$2,298	24	$27,197,482	13
St. Johns	22,998	$5,322	14	$5,054	51	-$267	55	-$6,149,016	55
St. Lucie	32,322	$3,725	35	$5,138	42	$1,413	32	$45,668,042	8
Santa Rosa	23,856	$2,339	55	$5,004	60	$2,665	16	$63,571,771	5
Sarasota	39,602	$8,978	2	$5,393	10	-$3,585	66	-$141,993,505	64
Seminole	64,301	$4,801	21	$5,036	57	$235	49	$15,090,791	25
Sumter	6,648	$3,185	43	$5,062	49	$1,877	29	$12,477,757	32
Suwannee	5,643	$2,500	54	$4,979	63	$2,479	20	$13,987,211	27
Taylor	3,230	$3,587	37	$5,133	43	$1,546	31	$4,994,228	44
Union	2,129	$1,190	66	$5,187	34	$3,998	3	$8,511,891	39
Volusia	63,673	$4,741	22	$5,209	32	$468	45	$29,780,795	12
Wakulla	4,584	$1,533	61	$5,392	11	$3,858	5	$17,684,945	21
Walton	6,372	$7,432	7	$4,880	67	-$2,552	63	-$16,262,689	57
Washington	3,999	$1,837	58	$5,411	9	$3,574	11	$14,291,612	26

Table 2.2 District Cost Factor Indexes

County	DCD	Rank	SRI	Rank	ASI	Rank	ECFI	Rank
Alachua	0.9546	34	1.0055	13	0.9968	35	0.9568	43
Baker	0.9398	50	0.9546	64	1.0247	26	0.9192	65
Bay	0.9446	43	1.0010	18	0.9968	35	0.9425	55
Bradford	0.9438	45	0.9810	42	1.0365	22	0.9596	41
Brevard	0.9700	19	0.9976	23	0.9968	35	0.9646	35
Broward	1.0539	4	1.0058	12	0.9968	35	1.0566	5
Calhoun	0.9257	65	0.9725	53	1.1163	2	1.0050	15
Charlotte	0.9596	31	0.9837	39	0.9968	35	0.9410	56
Citrus	0.9356	57	0.9821	40	1.0144	32	0.9321	58
Clay	0.9540	35	0.9784	43	0.9968	35	0.9305	60
Collier	1.0169	5	1.0245	2	0.9968	35	1.0385	7
Columbia	0.9288	61	0.9757	46	1.0209	29	0.9252	63
Miami-Dade	1.0608	2	1.0070	11	0.9968	35	1.0648	3
De Soto	0.9599	30	0.9750	50	1.0170	30	0.9518	46
Dixie	0.9383	54	0.9996	22	1.0751	13	1.0084	11
Duval	0.9713	16	0.9860	36	0.9968	35	0.9546	44
Escambia	0.9442	44	0.9866	33	0.9968	35	0.9286	62
Flagler	0.9668	23	0.9849	37	0.9968	35	0.9492	48
Franklin	0.9631	25	0.9747	51	1.0493	17	0.9850	25
Gadsden	0.9465	42	0.9755	48	1.0741	14	0.9918	22
Gilchrist	0.9307	59	1.0033	15	1.1041	5	1.0309	8
Glades	0.9697	20	0.9645	60	1.1120	4	1.0400	6
Gulf	0.9401	49	0.9757	47	1.0980	8	1.0071	12
Hamilton	0.9218	66	0.9933	29	1.0802	10	0.9890	24
Hardee	0.9468	40	0.9680	57	1.0165	31	0.9316	59
Hendry	0.9771	13	0.9701	54	1.0346	24	0.9807	27
Hernando	0.9393	51	0.9755	49	1.0039	33	0.9198	64
Highlands	0.9484	37	0.9882	32	1.0346	23	0.9696	31
Hillsborough	0.9993	8	1.0009	19	0.9968	35	0.9970	21
Holmes	0.9326	58	0.9588	61	1.1152	3	0.9972	20
Indian River	0.9704	18	0.9934	28	0.9968	35	0.9610	40
Jackson	0.9214	67	1.0199	4	1.0711	15	1.0066	13
Jefferson	0.9580	32	0.9544	65	1.0983	7	1.0042	17
Lafayette	0.9278	62	0.9671	58	1.1211	1	1.0059	14
Lake	0.9610	28	0.9814	41	0.9968	35	0.9401	57
Lee	0.9833	9	1.0107	8	0.9968	35	0.9907	23

Continued…

Table 2.2 District Cost Factor Indexes (Continued)

County	DCD	Rank	SRI	Rank	ASI	Rank	ECFI	Rank
Leon	0.9709	17	1.0037	14	0.9968	35	0.9714	30
Levy	0.9374	56	0.9945	26	1.0780	11	1.0050	16
Liberty	0.9421	46	1.0899	1	1.1030	6	1.1325	1
Madison	0.9421	46	0.9563	62	1.0462	18	0.9426	54
Manatee	0.9807	12	1.0072	10	0.9968	35	0.9846	26
Marion	0.9471	39	1.0024	16	0.9968	35	0.9464	51
Martin	0.9832	10	1.0192	5	0.9968	35	0.9989	19
Monroe	1.0846	1	0.9897	31	0.9968	35	1.0700	2
Nassau	0.9466	41	0.9701	55	1.0382	21	0.9533	45
Okaloosa	0.9483	38	0.9976	24	0.9968	35	0.9430	53
Okeechobee	0.9615	26	0.9847	38	0.9981	34	0.9450	52
Orange	0.9816	11	1.0223	3	0.9968	35	1.0003	18
Osceola	0.9688	21	1.0136	6	0.9968	35	0.9789	28
Palm Beach	1.0600	3	1.0012	17	0.9968	35	1.0579	4
Pasco	0.9653	24	1.0007	20	0.9968	35	0.9629	39
Pinellas	1.0142	6	0.9999	21	0.9968	35	1.0109	9
Polk	0.9615	26	0.9697	56	0.9968	35	0.9294	61
Putnam	0.9405	48	0.9973	25	1.0334	25	0.9693	32
St. Johns	0.9736	14	0.9923	30	0.9968	35	0.9630	38
St. Lucie	0.9683	22	0.9860	35	0.9968	35	0.9517	47
Santa Rosa	0.9390	52	0.9761	45	0.9968	35	0.9136	67
Sarasota	0.9998	7	1.0123	7	0.9968	35	1.0089	10
Seminole	0.9728	15	0.9944	27	0.9968	35	0.9643	36
Sumter	0.9380	55	0.9775	44	1.0448	20	0.9579	42
Suwannee	0.9298	60	0.9652	59	1.0563	16	0.9479	50
Taylor	0.9507	36	0.9537	66	1.0460	19	0.9484	49
Union	0.9273	64	0.9741	52	1.0755	12	0.9715	29
Volusia	0.9606	29	1.0096	9	0.9968	35	0.9668	33
Wakulla	0.9570	33	0.9861	34	1.0234	27	0.9658	34
Walton	0.9387	53	0.9556	63	1.0228	28	0.9174	66
Washington	0.9275	63	0.9535	67	1.0898	9	0.9637	37
Minimum	0.9214		0.9535		0.9968		0.9136	
Maximum	1.0846		1.0899		1.1211		1.1325	
Range	0.1632		0.1364		0.1243		0.2189	

A regression of the log of the ratio of funds allocated to funds raised, Log Ratio, on log population, squared log population, and log per capita income yields:

$$\underset{(2.9)}{\text{Log Ratio} = 15.92} - \underset{(0.48)}{0.75} \times \text{Log Population} + \underset{(0.02)}{0.03} \times \text{Squared Log Population} - \underset{(0.23)}{1.07} \text{ Log Per Capita Income} \qquad (2.1)$$

$R^2 = 0.6006$

Observations =67

where the standard errors are in parentheses. Thus, a reasonable representation of the FEFP is that it redistributes from richer counties to poorer counties and, for a given level of per capita income, from medium size counties to small and large counties. There are reasons for this. First of all, the tax base per student is higher where per capita income is higher. Second, the DCD tends to be higher in larger counties, the sparsity supplement tends to be higher in smaller counties, and program cost factors tend to be larger in small or large counties, so, holding the tax base constant, cost factors redistribute away from medium sized counties. To anticipate what is to come, we think that too much is being directed to small counties and the very largest counties at the expense of medium to large counties, resulting in disequalization of real base funding and funds allocated proportional to base funding. With this understanding of the joint role of the DCD, which is based on the Florida Price Level Index (FPLI), and the sparsity supplement in the FEFP, we now turn to a detailed consideration of each of them individually.

3. The Florida Price Level Index: The Basis of the District Cost Differential

3.1 Introduction

This portion of our report considers the FPLI in detail, and the discussion is organized as follows. We first review the current methodology and recent revisions that have been made based upon BEBR's ongoing study of the FPLI. Second, we consider the principal remaining problem – that the current FPLI does not adjust in a general way for amenity differences across space, and therefore overestimates the cost of living in Florida's expensive but high-amenity counties. Costs are higher in these counties because people are, to some extent, happy to pay them in order to live in desirable locations. Since the current FPLI misses this important aspect of differences in hiring costs across districts, it transfers too many resources to expensive but high-amenity districts from other districts. Third, we treat in a non-technical manner the effects of amenities on wages and general arguments for including an amenity-adjustment in the FPLI. Fourth, we determine whether an index using general labor market wage data to calibrate an amenity adjustment is a reasonable predictor of teacher salaries or, if instead, teacher labor markets are so different than other labor markets that a general wage data are not useful. Fifth, we detail how such an index could be constructed and how a DCD based on such an index would differ from one based on the current FPLI. While we, along with other school finance authorities that have studied the issue (Hanushek, 1997; McMahon, 1994), strongly recommend against forming a personnel cost index based on actual district level teacher salaries, we conclude our discussion of the FPLI itself by carefully considering what would happen in if such an index were indeed adopted.

3.2 FPLI Current Methodology and Recent Revisions

The Florida Price Level Index (FPLI) is an indicator of the cost of living in individual counties of the state, relative to the state average, at a particular point in time. It is used by Florida as the basis for its calculation of the District Cost Differential (DCD), which in turn is used to index base-per-student funding for variations in the cost of hiring similarly qualified personnel across counties. The formula for the i^{th} county's DCD is:

$$DCD_i = 0.2 + 0.8 \times (\text{3-Year Average } FPLI_i) \quad (3.1)$$

The reasoning behind the formula for the DCD is that approximately 20% of school districts' expenditures go for books, chalk, and other items whose prices are close to being identical across districts. The other 80% is for personnel, and the justification for using a price index is that a school district with a cost of living, say, 5% higher than the average for the state, would have to pay compensation 5% higher per worker to obtain teachers and other personnel of the same quality as the average for the state.[1] The DCD is based on a three-year average of the FPLI to smooth real changes and reduce the effect of random fluctuations.

Technically, the FPLI is a weighted average of the relative prices of a number of goods, where the relative price is the county's average price divided by the state average price. The underlying methodology borrows heavily from the Consumer Price Index (CPI) calculated by the U.S. Bureau of Labor Statistics (BLS). One difference between the CPI and the FPLI is that the federal government has the resources to collect prices on more individual items than it is cost effective for Florida to collect for the FPLI. Another is that the CPI measures variation in the price level across time, while the FPLI is

[1] An implicit assumption behind the linear form of equation (3.1) is that school districts having to pay higher wages do not substitute capital for labor. For example, a school district paying wages 10% higher than another district is assumed not to respond by using more computers than the other.

intended to measure variations in the price level across counties in Florida at a point in time. While many theoretical issues are the same for spatial and temporal cost of living indexes, the importance of particular issues varies greatly depending upon the context. Since 1995, BEBR has undertaken an extensive review of the methodology of the FPLI, which has resulted in a series of methodological improvements.

3.2.1 Item specification.

The first was to simply standardize items as much as possible. i.e., to make sure apples were being compared to apples, not oranges. Clearly, pricing an expensive brand of men's loafer at an upscale clothing boutique in one county and an economy brand in a large retail outlet store in another will result in an inappropriately skewed index. The research and recommendations relating to this change are detailed Denslow, Honeyman and Rasmussen (1996), one of BEBR's earliest research reports on the FPLI.

The next major changes implemented had to do with the apartment rent and house price items, the two most influential items in the FPLI. The changes to the apartment rent item were largely technical in nature and were designed primarily to eliminate bias that resulted from confusing differences in rents occurring because richer populations demanded nicer apartments, and those differences in rents occurring because it cost more to provide the same apartment services in one county than another. The changes to the house price item dealt with the measurement of the cost of a standard residential lot. Chiefly, they involved ensuring that large lots in some counties were not compared with small lots in other counties and that the influence of outliers and tainted data was minimized. Denslow, Dewey, and Scoggins (1999) provide detailed discussions of these revisions and the research behind them.

3.2.2 Item selection.

The CPI is based on the prices of a large number of items. However, while the federal government finances the CPI, the FPLI is conducted with a very limited budget. Therefore, the FPLI must be based on a much smaller number of items. When selecting the set of items to price for the FPLI, the limited resources should be spent so as to maximize the ability of the index to measure spatial variation in the price level.

In extensive research conducted from 1998 to 2000, BEBR showed that of the 117 items historically priced for the FPLI, most goods (as opposed to services) did not vary in price in any significant and systematic way across counties once fully standardized, as recommended by earlier research. Put differently, a basket of identical goods including food, clothes, tools, and similar transportable items purchased at Super Wal-Mart would cost about the same no matter which county it was purchased in. There are two reasons for this. First, highly transportable goods can quickly be diverted from low price counties to high price counties by businesses looking to increase profits. Second, shoppers are highly mobile, allowing them to buy in cheaper counties if prices are high in their county, thus limiting the ability of establishments in any one county to charge high prices – even if there are few competing firms within a particular county.

This research clearly implied that focusing on the goods having high budget shares, those having moderate budget shares but varying widely across counties due to some basic lack of transportability, and assuming that all other goods cost the same in all counties, would yield a more accurate FPLI, one less prone to random fluctuation and considerably less expensive to construct. Beginning with the year 2000, BEBR was given the task of implementing a methodology consistent with these findings. Denslow, Dewey, and Scoggins (1999), Denslow and Dewey (1999), and Denslow and Dewey (2000) detail this research and the accompanying recommendations.

3.2.3 Index form.

One area in which a great deal of research directed at improving temporal price indexes, such as the CPI, has been conducted has to do with substitution bias in additive fixed-weight price indexes. The FPLI is an additive fixed-weight index, meaning that it is a simple weighted average of the prices of a number of goods and services, relative to the state-wide average prices, where the weights are determined by each item's share of the typical consumer's budget. Schultze (2003), Abraham (2003), and Hausman (2003), provide a relatively simple and up-to-date discussion of this and related issues. Additive fixed-weight indexes provide a comparison of the expenditure required to purchase an identical basket of goods in two different years or in two different counties. Implicitly, the additive index assumes that consumers always prefer to consume goods in fixed proportions to one another, and that, in order to fully compensate for higher prices, consumers must receive enough additional income to allow them to purchase exactly the bundle of goods and services purchased before the price increase. This assumption ignores the fact that consumers can economize by substituting away from those goods that have experienced the largest price increases.

To see the basic problem with the additive fixed-weight construction, suppose that a teacher annually spends \$50 on apples and \$50 on bananas. If the price of apples doubled, but the price of bananas remained the same, she would need an extra \$50 to buy the same bundle of goods and services. However, given an extra \$50, it is likely that she would substitute away from apples but towards bananas or other types of goods and services. Since she could have purchased the same bundle as before with an extra $50, but would instead chose to substitute something else for some of the apples she consumed prior to the price change, it follows that she would be better off with the extra $50 facing the higher price of apples than she was before the price of apples increased. Therefore, she requires less than an additional $50 of disposable income to compensate for the increased price of apples.

For an example more relevant to the FPLI, assume that the prices of all goods and services except housing were the same in Palm Beach County and Highlands County, and that housing costs twice as much in Palm Beach as in Highlands. Now, imagine a teacher who initially lived in Highlands and who moves to Palm Beach. Suppose that, of a disposable income of $24,000, she chose to spend $8,000 annually on housing and $16,000 on everything else when living in Highlands. To purchase the same bundle of goods and services in Palm Beach, she would need to spend $16,000 on housing and $16,000 on everything else, for a total of $32,000. Does this mean it would take 33% more income to induce our teacher to willingly move to Palm Beach, assuming purchasing power is her only concern? Since housing is relatively much more expensive in Palm Beach, given 33% more disposable income, most people would choose to buy a bit less housing and spend some of the savings on other things – substituting other goods and services for housing. Given 33% more income, she would be able to purchase the same bundle in Palm Beach as she had been able to purchase in Highlands, but she would choose to purchase a different bundle. It follows that our teacher would need less than 33% additional income to compensate for the higher prices in Palm Beach.

To implement a non-fixed weight index, we would need data on expenditure patterns for all 67 of Florida's counties, or, at least for its major counties. However, such data is available only for Tampa and Miami. Therefore, the only practical alternative is to construct a fixed-weight index that allows for some degree of substitution. BEBR researched the use of a geometric fixed-weight index, which is a weighted geometric mean of relative prices, and found that it produced almost identical results, with slightly more variation among counties. While the geometric construction allows for some degree of substitution, it may not be reflective of actual preferences. Just as the additive construction implicitly assumes goods are consumed in fixed proportions relative to one another, regardless of price, the geometric construction assumes that the same portion of income is spent on each good, regardless of price. This is not necessarily a better approximation than fixed proportions. Since the additive and geometric indices are very similar, since there is no clear reason to think fixed expenditure shares is more useful than fixed proportions as an approximation of real preferences, and since the additive index is in some ways simpler, BEBR then recommended and continues to recommend retaining the additive construction.

3.2.4 Item weights.

The derivation of the weights placed on the relative prices is the only element of the FPLI remaining to be reviewed. BEBR relies upon the CPI weights calculated for the Tampa area by the U.S. Bureau of Labor Statistics (BLS) based upon their Consumer Expenditure Survey (CES), and also directly upon data from the CES. BEBR's weighting scheme differs from that of the CPI in three respects. First, the CPI is intended to represent a temporal cost of living index, and it weights only goods and services, not savings. Placing no separate weight on savings is reasonable in a temporal context, since the value of savings will depend upon how much can be purchased with them. Thus, the price of "savings" may be thought of as proportional to the price of goods and services. However, workers in different counties must be able to purchase comparable amounts of goods and services and save the same amount for the future. Since workers are not tied to a particular location in the future, the level of savings for the future should not vary with the cost of goods and services in the current county of residence. Since owned homes are a large share of expenditures and a large investment for the future, this means that accounting for home appreciation properly becomes crucial.

Second, workers must pay federal income tax from their earnings. However, since the income tax is progressive, if goods and services cost 10% more in one county than another, wages would have to increase by slightly more than 10% to maintain equivalent purchasing power. At the same time, mortgage interest is deductible; meaning that accounting for the income tax reduces the price of housing in high cost of living areas. Therefore, it is important to factor the need to pay income taxes into a spatial cost of living index.

Third, and related to the first previous, the CPI uses a rental equivalence concept to calculate the weight to be placed on owner occupied housing. The CPI uses rental equivalence to purge housing of its value as an investment, thus measuring the expense related only to the user-costs of owner-occupied housing. Rental equivalence, however, is difficult to implement since nearly all single-family detached housing is owner occupied and since nearly all renters live in attached housing, making it difficult to impute what the "equivalent" rent for any given home would be. This means that there may be a large degree of error associated with rental equivalence imputations. Moreover, there is a good reason that most single-family detached housing is owner-occupied – renters will not have appropriate incentives to care for the housing units they occupy (Glaeser & Shapiro, 2002). This means that rent on single-family detached housing must compensate for the user-costs of housing and also for the extra maintenance costs that occur when a single-family detached unit is rented. This will cause rental equivalence to overestimate housing costs relative to an accurate direct measure of user-costs. Furthermore, increases in wealth due to house price appreciation must be properly accounted for given that we are defining purchasing power broadly to include purchasing power this year and the amount of wealth carried forward to next year. This difficulty with the CPI housing weight was discussed in Denslow and Dewey (2000).

BEBR calculates the user-cost of housing by adding the interest, property tax, insurance, and depreciation costs associated with owning a home with a market value equal to the Florida median, factoring in the mortgage interest deduction, and then subtracting expected house price appreciation, which is a form of income or saving for the future. While most of these components are easily gathered, an accurate measure of house price appreciation is more difficult to obtain. In 2000, 2001, and 2002, BEBR used the national average house price appreciation for the previous year to proxy next year's expected house price appreciation. This resulted in a weight on housing far below that suggested by the CPI. Since homes in Florida have appreciated faster than the national average, however, this tended to slightly overestimate the weight on housing. For 2003, BEBR located and used a new source of information on house price appreciation, an index compiled by the Office of Federal Housing Enterprise Oversight (OFHEO). To act as a proxy for expected future house price appreciation, BEBR used the 10-year OFHEO state average house price appreciation.

Since homes in Florida have appreciated more rapidly than the national average, this change resulted in a lower weight on housing than in recent years, and a corresponding decline in the spatial variation of the FPLI. However, it will not necessarily halt the general upward trend in the spatial variation of the FPLI observed in recent years. This trend has been driven by the increasing level of house prices, particularly in the southern region of the state. If housing costs continue to increase more rapidly than other goods and services, and if land in the southern part of the state remains much more expensive than the state average, as will likely be the case, the upward trend in the variation of the FPLI will continue, albeit at a temporarily lower level.

To see how large the effect of this weighting methodology, and, particularly, the use of user-costs rather than rental equivalence is, consider that the 2003 CPI weight for owner-occupied housing was 23.48. Factoring in house price appreciation, tax structure, savings, and other forms of expenditure not weighted in the CPI such as life insurance and cash contributions, BEBR calculated a weight of 8.58% in the 2003 FPLI for the user-cost of owner-occupied housing. This figure would be somewhat higher for a reference group consisting only of homeowners, who are only 74.12% of the actual reference group. Since owner-occupied housing exhibits more spatial variation than any other component of the FPLI, the spread between the highest and lowest districts' FPLI would be 35 with the CPI weighting, as opposed to only 17 with the BEBR weighting. Similarly, while the average absolute deviation from the state average is only 3.67 with the 2003 BEBR weighting, it would be 7.55 with the CPI weighting. Careful measurement of the user-cost of housing thus results in a significant reduction in the spatial variation of the FPLI. While the spatial variation of the FPLI has risen moderately in recent years, before falling this year with the new source of data on home appreciation, it would have risen much more with the CPI weighting.

3.3 Amenity Adjustments in a Spatial Cost of Living Index

Since the overwhelming share of school spending goes for personnel, responding to a mandate to equalize educational opportunity among districts requires, as a major component, a measure of the cost of personnel. Thus, the FPLI is essentially used as an index of the cost of obtaining similarly qualified personnel in different school districts. While the research and methodological revisions discussed above have been extensive, no matter how accurately we measure differences in the monetary costs of goods and services across counties, the FPLI still comes up lacking as a measure of personnel costs in one important way – the monetary costs of goods and services is not the only factor that affects the cost of maintaining a given standard of living. Amenities – features that cause people to favor living in one place over another – should be accounted for in addition to monetary costs in the calculation of a complete cost of living index.

We illustrate this with an admittedly contrived example (borrowed from Denslow and Dewey, 2000), useful for developing the intuition behind this concept. Consider three counties, Acorn, Beach, and Castle. Acorn is a small farming community, noted primarily for its lovely oak trees. Beach contains a sizable city on the Atlantic, with many retirees and a work force that provides services to them. Castle, on the Gulf, has no sandy beaches but does contain a large port city. Table 3.1 presents a price level index and the average money wage for each county. All workers everywhere are equally skilled.

Table 3.1 Illustrative Example

County	Price Level	Average Wage
Acorn	100	$30,000
Beach	110	$30,000
Castle	110	$33,000

Both Beach and Castle have prices that average 10% higher than Acorn's. In Beach, retirees wanting to live on the ocean have bid up land prices, and, consequently, apartment rental rates and house prices. In Castle, the price of land has also been bid up by companies seeking locations close to the port and by their workers, buying houses within easy commuting distance. In Castle, a county with no more amenities than Acorn, wages are 10% higher to compensate for the higher prices. In Beach, however, wages are no higher than in Acorn. In spite of higher house prices and rents, employers in Beach can compete with those in Acorn because of the amenity of living in Beach – proximity to a sandy beach in a temperate climate.

This story is straightforward so far. Wages are higher in places with a high cost of living but lower in places with high amenity levels. Often the two effects are either fully or partially offsetting. The primary cause of the differences in prices is variation in the cost of land – and thus, rents and house prices. We complicate the story a bit by noting a second source of variation in the cost of living: in Castle, hair care and hamburger lunches may cost more because barbers, beauticians, and fast food workers require more pay in compensation for the higher cost of living. That would not be true in Beach. What about cars and shoes? Will they cost most in Acorn, Beach, or Castle? To a close approximation, they should cost the same everywhere, since they can be shipped easily from one county to another. True, the cost of renting property for a car lot will be higher in Beach and Castle than in Acorn, and the wages of sales personnel will be highest in Castle. But that effect will be offset by the fact that Beach and Castle, with larger urban areas, sell more cars per year, per acre and per sales representative. Moreover, consumers in those counties have a wider choice of dealers with whom to bargain. The same holds for shoes.

Which column in Table 3.1 would be the best one for estimating differences in school costs among counties, the cost of living or the average wage? The clear answer is the average wage column. Even though Beach has a higher cost of living than Acorn, because of its amenity it can hire teachers for the same compensation. Castle, in contrast, must pay teachers 10% more than either Acorn or Beach. In practice, since high amenity areas tend to attract larger and wealthier populations, this means that price indexes will tend to overstate costs in larger or wealthier areas. For equalizing real school funding, it is clearly important to account for amenities. A price level index without an amenity adjustment is merely a step toward what we really wish to measure – spatial variation in the cost of maintaining a given standard of living, and thus spatial variation in the cost of hiring equally qualified personnel.[2]

Thus, the argument in favor of using an index that accounts for amenity differences is straightforward. When choosing where to work, teachers join other workers in considering not only pay and the cost of living but also various amenities, which include taxes, public services, climate, and scenery. Use of the FPLI in its present form implicitly assumes that teachers and other school employees do not consider amenities, basing their

[2] We are taking as given the state's desire to equalize real educational resources across districts. That is, in this part of the report we are not taking a position on that goal, which is a separate issue.

decisions only on the ratio of pay to the cost of living. Using wage data, it is possible to construct an index that reflects both the price of goods and services and amenities.

The effect of amenities on wages is a task in which intuition may fail us. The overwhelming majority of us would rather live in Florida than in Alaska. You would have to pay most of us quite a bit more, a "compensating differential" as economists call it, to induce us to move to Alaska and do the same work there we do here. That would be true even if the prices of goods and services in the two states were the same. Alaska would be a great place to visit, we think, but not to live. At least one author of this report thinks Gainesville – with its year-round outdoor recreational opportunities and interesting colleagues at the University of Florida – is a great place to live, and that Tallahassee would be passable. One of his younger colleagues, however, could barely endure life without the cultural amenities of a major urban center. That young scholar now resides and works happily in London. There is no debating taste.

Another reason introspection fails us in thinking about the value of amenities is that the places most young college graduates would not prefer to live do not anyway need to hire many teachers. Hamilton County, for example, would likely be too rural for many fresh college graduates. But there are teachers who prefer the rural life. It needs to attract only one out of every 1,000 teachers in Florida, and there may well be that many who are either there and like it or would prefer to be there instead of where they are. More generally, Florida's 25 smallest counties measured by population are quite rural, but, as a group, they need to attract only one out of every 25 of the state's teachers, and there may well be that many teachers who prefer rural life. This question is empirical.

Differing tastes also matter with respect to differences in the cost of living. Some people prefer to live in large houses with large adjoining lots, and they thus choose to live where land is cheap. Others are quite happy with apartments and might be more likely to live in large cities. There are actually people who find a fifty-minute morning commute so relaxing that commuting is almost a consumer good for them, and they thus might work in a city but reside in rural communities to take advantage of lower land prices.

All of these considerations suggest that an index using wage data to allow for an amenity adjustment would be better than a simple price index. One might think an obvious way to do this would be to use what the various school districts pay teachers and other employees. This method is flawed, however, in that districts would be rewarded for paying above-market wages by receiving more funds from the state (Hanushek, 1997; McMahon, 1994). We consider the problems inherent in this approach in greater detail in section 3.6.

The next most obvious way would be to use wages paid by other employers to measure the effect of amenities (Hanushek, 1997). A price index has been used for the first three decades of the DCD because of the impracticality of constructing a wage index in this manner. Only recently has an annual source covering every county of the state with detailed occupational classifications become available. The BLS, in collaboration with the states, has begun the annual collection of wages for detailed occupations across the country, with widespread geographic coverage within each state, in their Occupational Employment Statistics (OES) survey. From the Labor Market Information (LMI) division of Florida's Agency for Workforce Innovation, it is now possible to obtain detailed information on wages for a wide variety of finely classified occupations for all 67 Florida counties.

In order to control for the effect of amenities, it is necessary to control for differences in the workforce across counties. If total wage payments in each county were simply divided by the number of workers in the county, the resulting index would overstate costs in counties in which workers were on average more skilled or jobs were more demanding on average. This difficulty prevented BEBR from recommending using wage data in the construction of an amenity-adjusted FPLI in the past. By finely classifying workers into occupations, the OES sharply reduces this problem. If the occupational classification were sufficiently fine within occupations, the qualifications of workers and the difficulty of the job would be identical across counties.

Extensive empirical efforts have persuaded us that we can construct an index that effectively controls for variations in labor skill. Hundreds of wage studies have been undertaken confirming that wages vary positively with education, accumulated on-the-job training, innate skill, the cost of living, local disamenities, and unpleasant job characteristics. But the data available both frequently and with reasonable spatial detail, which are from the OES, do not include measures of workers' education, experience, and innate skill. They do, however, provide detailed occupational classifications and within-occupation wage distributions. As described elsewhere, we think this information can be used to construct a wage index that controls adequately for workers' skill differences.

Of course, the actual OES classification is not perfect. For instance, while janitorial workers probably perform comparable tasks across all counties, lawyers may not. For instance, highly paid international tax lawyers may be located disproportionately in a few large counties. To the extent that this type of sorting occurs across counties within the relatively fine OES classifications, errors may enter our wage index. It is likely, however, that the distribution of skills of masons, for example, will be much the same in one city as in another. More generally, it might well be that for some reason masons tend to be more skilled in one city than in another, but the truck drivers in the first city are more skilled than their colleagues in the second. Perhaps the city with more skilled carpenters has less skilled filing clerks. That is, on average across a large number of occupations, the skill difference may wash out, at least approximately. We can reduce what potential error remains somewhat by use of statistical smoothing and by imposing economically reasonable constraints. Furthermore, while empirical work has shown such an index to be quite stable and consistent, some error is unavoidable in any spatial cost of living index. Thus, Denslow and Dewey (2000) recommended employing these data to adjust for amenity differences.

3.4 Do Teacher Salaries Adjust Like Those of Other Occupations?

One assumption underlying this approach is that the market for teachers adjusts compensation to spatial variations in the cost of living and in amenities in much the same way markets for other occupations adjust their wages, or at least that the outcomes have similar patterns. That is, a fundamental assumption of using wage data to adjust for amenities is that teachers' households are similar to households of other workers with respect to preferences determining how wages vary across locations. In addition, a complication for empirical work is the question of whether teachers' wages are negotiated in a way that reflects these preferences with an outcome that resembles that for other occupations.[3] However, if teacher markets do not work like other markets, then not only is an amenity-adjusted cost of living index unsuitable, but the use of a price index unadjusted for amenities is just as inappropriate. Thus, if teacher markets are like other markets, a wage-based amenity adjusted price level index is best, while if teacher markets are nothing like other markets, neither an amenity-adjusted FPLI nor the current FPLI is suitable.

The objective is to construct an FEFP, and within it a DCD, that results in giving to each district an opportunity to provide a certain quality of education to its children. What if, however, most of a district's residents fail to vote in school board elections and effectively turn control of the board over to a teachers' union? Must the state then accept that control and the resulting above-normal pay for teachers as a constraint with which that district has to deal with and send extra funds its way to enable it to do so? Our view is that the answer to this question is no. The charge, as we interpret it, is to construct a DCD that enables each district to provide a certain quality of education on the assumption that a majority of its residents retain control of the school board and provide educational services as efficiently as possible.

Teachers, to return to the rationale for an amenity-adjusted index, are like other workers in that, subject to the constraint of having a job offer, they may choose where to work. In making that choice they are likely to consider the same variables as other workers. The chief argument for using an amenity-adjusted index based on wage data as an indicator of the cost to a school district of hiring teachers is that doing so skips the

[3] This statement will be elaborated later. For example, it may be that the wages of teachers do not display the same geographic pattern as those of other occupations, but that the differences stems mainly from the greater unionization of teachers. If unions gain higher salaries, the issue arises of whether districts with unions should be compensated, by the state, for the cost of union-induced higher salaries.

intermediate step of relating wages to prices and amenities. Instead, the procedure is to calculate a general wage index and assume it applies to teachers as well. But wages for teachers may have spatial patterns that differ from wages for other occupations. First, it is clear that the market for teachers is organized differently from most other labor markets. Second, variations in working conditions may matter more in teaching than in most other occupations. Third, although teachers may have preferences for amenities and public services just as other workers do, they may weight those amenities and public services differently. In considering whether incorporating an amenity-adjusted index into the DCD meets the aims of that measure, we must consider these differences.

For clarity and emphasis, we again list three major groups of reasons to expect that the spatial pattern of teachers' pay may differ from that of an amenity-adjusted FPLI constructed using wage data from other occupations, and we consider each in turn: (1) The structure of the labor market for teachers differs from other labor markets; (2) job characteristics may matter more for teachers; and (3) teachers' preferences may differ from those of other workers.

3.4.1 The structure of the labor market for teachers.

Perhaps the two most important ways in which the labor market for teachers differs from most other labor markets, and certainly from those for most other professional workers, are that teachers are far more likely to be unionized and far less likely to receive merit pay of any significance. Borjas, citing Hirsch and Macpherson (1999), notes that unions represented less than 10% of private sector workers in 1998. For teachers, calculating the share in unions is complicated by the need to distinguish unions from professional associations. Members of the American Medical Association, (AMA) for example, generally do not consider themselves union members, even though the AMA lobbies Washington heavily in favor of improved conditions for incumbent physicians. Similarly, many teachers who belong to organizations that negotiate compensation with school boards do not respond to surveys that they are union members. Wherever the line between union and professional association is drawn, however, teachers are heavily organized. In 2000, 42% of K-12 teachers who responded to the March 2001 Current Population Survey said they were union members, and at least 47% of all K-12 teachers were covered by union contracts.[4] No other job category had as large a share of its workers covered by a union contract.

Unionization and the absence of merit pay may be related. When workers in other occupations are unionized, a common result is to compress pay levels. For teachers, the strength of the relation is unclear, however, since even non-unionized districts avoid merit pay.[5] In public K-12 education in most cases the leveling of pay schedules extends even to the refusal to pay teachers significantly more in fields where qualified people are relatively scarce, such as math, some sciences, and special education. Moreover, few districts offer economically meaningful extra compensation for serving in low-socioeconomic status (SES) schools or for commuting to downtown.

Unions are one reason pay schedules for teachers tend to be heavily backloaded, where backloading is defined as a rising ratio of pay to marginal product with tenure. To illustrate, suppose a teacher with twenty years' seniority is 5% more productive than a teacher with five years, but receives 20% more pay. That represents 15% backloading for the more senior teacher. In fact, teachers with 20 years experience are likely to be paid

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[4] Zwerling and Thomason (1995) estimate that 68% of local public school teachers are unionized.
[5] See Podgursky and Ballou (2001) for a discussion on merit pay for teachers.

more relative to what they achieve than are teachers with five years experience, and that phenomenon is more striking than in most occupations (for a discussion of backloading by occupation, see Topel, 1991).

Teachers' pay schedules usually emerge from bargaining with school boards, perhaps a less competitive process than private firms engage in when hiring employees. If the school board enjoys a local monopsony because it is in a large city with only one district, the board might enjoy greater bargaining power, enabling it to pay lower salaries than in cases where there are competing districts. That effect could be reduced, however, if teachers, perhaps through their unions, influence the outcomes of school board elections. Many school board members are teachers, former teachers, or close relatives of teachers. This could mean simply that the electorate prefers school board members who know the industry they regulate. Alternatively, it could mean that teachers use campaign assistance and votes to elect members who will pay them generously. Other things the same, unionized teachers receive 15% to 20% more pay than their non-union colleagues in other districts.[6]

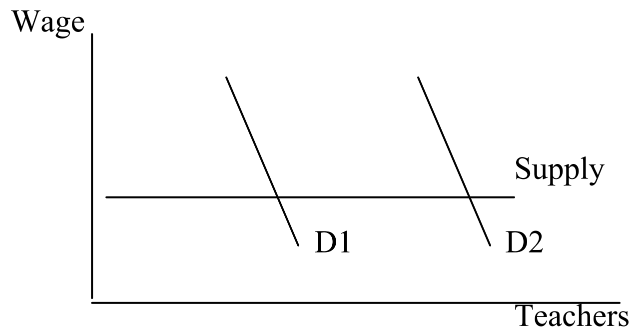
There is a further issue regarding merit pay, what economists call the *principal-agent problem*. In the context of this principal-agent model, the school principal confusingly enough is the economic agent of the local community, the economic principal. So call the school principal the supervisor. This supervisor, serving as the agent of the community, is the person best positioned to observe the quality of a teacher, which is quite difficult to measure objectively. But that supervisor is unlikely to be rewarded strongly for improving the overall quality of the school, and thus has only weak financial incentives

[6] Zwerling and Thomason (1995) place the relative wage effect of teacher unions in the range of 15% to 20%.

to bear the burden of rewarding teachers for superior performance either with higher pay or otherwise. The temptation would be to reward friends and squeaky-wheels instead of the best instructors. Perhaps one reason districts avoid merit pay is to keep the supervisors from favoring friends in this way.

Moreover, teachers must meet certification requirements set by the state, a feature shared with many other professions. As a result of the non-competitive elements introduced into the market structure teachers' wages depend on demand as well as on supply. If the market for teachers were perfectly competitive across space, the supply to a particular district would be perfectly elastic. The number of teachers employed would not affect the wage paid. The Palm Beach district, for example, employed 10,059 teachers in 2002-03 at an average salary of $45,437, the highest in the state. If the market were perfectly competitive, it could hire another 5,000 in net terms (i.e., replacing retirements and quits plus an additional 5,000 beyond that) at the same average salary, with no reduction in average quality. It is unlikely, of course, that they could do that within a year or two. The important question for our purpose here is whether they could hire 5,000 more than planned over the next decade, without pushing pay above what it would have been anyway and without compromising quality. If they could, then in the long run supply, not demand, determines teachers' compensation. In a diagram for Palm Beach with the number of teachers on the horizontal axis and their wage on the vertical axis, the supply curve would be horizontal. It would not matter where the demand curve crossed it. The wage would be the same.

Figure 3.1 Hypothetical Teacher Supply and Demand Diagram for Palm Beach



In sum, spatial variations in teachers' pay may be more affected by union strength, influence on school board elections, and other peculiarities in market structure than are wages of most other occupations. Unions are likely to affect the variation in wages across districts in at least two ways. First, teachers' pay will be higher, relative to their credentials and work rules, where unions exert stronger influence in school board elections. Second, teachers' pay is likely to be higher in districts where the demand for educational quality is less elastic, giving teachers' unions more bargaining power. For example, affluent school districts are likely to have less elastic demand for quality education. Also, it may be that, in comparison to poorer districts, affluent districts are relatively more concerned with teacher quality and less with class size. The effect on teachers' pay of having more elderly residents, however, is theoretically ambiguous. Unions are less likely to have influence on elections in districts with a large share of the population aged 65 and up since retirees turn out to vote and are more strongly concerned about property taxes than most residents. The cost per resident of additional spending per student, however, is lower in districts with a high ratio of residents to students, as is the case where there are many retirees.

These elements of market structure interact in complex ways. Setting a district-wide pay schedule, which as noted above, implies the same pay for teachers in central and suburban schools and in low-SES and high-SES schools results in more teachers without credentials in the central city and low-SES schools. Having a uniform wage schedule with backloading means that it will be set in a way that results in a political compromise among teachers within their union, and between the union and the school board, and among parents and property owners in areas feeding both low-SES and high-SES schools. Sorting out these effects is the subject of ongoing and widespread scholarly effort.

In summary, most policy makers would not want to shift resources from the rest of the state to districts to compensate for the cost of allowing teachers to control school boards or to more affluent districts. But union power does complicate relating teachers' pay to more general labor market wage data. That labor markets are competitive is an assumption underlying the construction and use of an amenity-adjusted index based on general wage data. Consequently, spatial variations in wages are caused by variations in supply, not demand. Teachers' unions and teacher-influenced school boards introduce elements of demand that obscure the relation between teachers' pay and variations in supply.

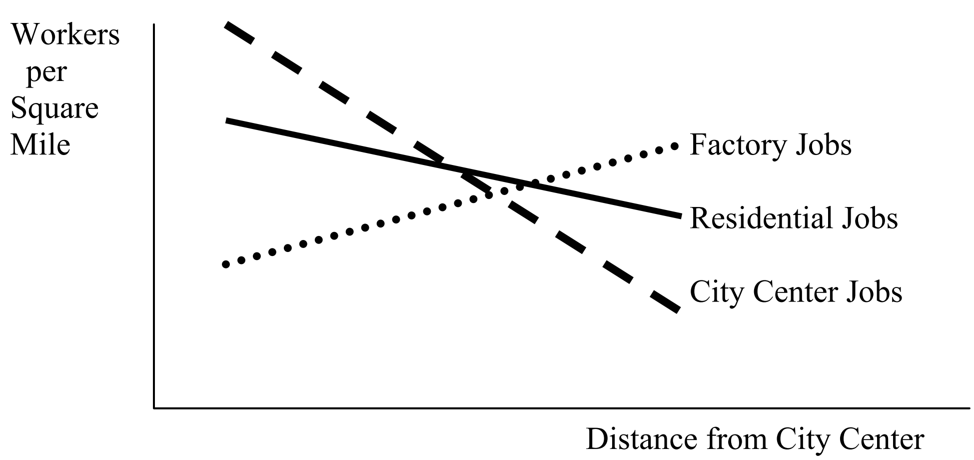
<u>3.4.2 Job characteristics of teaching</u>.

Teaching differs from many other jobs in terms of the location of work and the importance of student SES, class size, and work rules. Taking location of work first, urban jobs may be classified by whether they are predominantly in the central business district, more spread out into residential areas, or predominantly located on the outskirts.

Accordingly, we will classify jobs as city center, residential, and outskirts. One would expect most accountants to be located in or near central business districts, in order to be close to the businesses they serve and to other accountants. Teachers, in contrast, are more likely to work near where children live, in residential areas, to the extent that schools tend to be near where people live. Back-office clerks and factory workers are more likely to be on cities' rural outskirts, where land is cheap. To the extent that school districts are willing to substitute bussing for urban residential locations when land is very expensive, teachers may also work on the outskirts. Thus, we expect teachers to be intermediate in work location, less central than accountants, and perhaps even less central than some residential occupations.

Looking at it another way, various occupations have differing density gradients, or lines drawn on graphs that display distance from the city center on the horizontal axis and the number of workers per square mile (normalized for comparability) on the vertical.

Figure 3.2: Hypothetical Density Gradient Diagram



In Figure 3.2, the slashed line with steep negative slope represents jobs in firms that gain from daily interaction with other workers in the central business district. Frequent interaction is sufficiently important to such firms that they are willing to pay their workers extra to compensate for the cost of commuting or paying high rent near the city center. Moreover the firms are willing to pay high rent themselves. The dotted line with positive slope represents workers who are likely to be located in offices, factories or warehouses at the edge of the city, where land is cheaper, urban traffic congestion can be avoided, and workers can be within easy shopping distance of downtown but need not commute to work during rush hour. The full line with gentle negative slope represents jobs serving people near where they live, such as counter attendants at retail dry cleaning outlets. Barbers and beauticians might be expected to fall between resident and city center jobs: Some people want hair care near where they work, but others want it close to where they live.

We expect wages of city center jobs to vary most with city size, wages of outskirts workers least, with wages of residential workers intermediate. To illustrate, consider two counties on the Atlantic coast, Indian River and Palm Beach, with respectively 113,000 and 1,131,000 people. We expect outskirts workers to receive closest to the same pay, for a given skill level, between the counties, center city workers to receive considerably more in Palm Beach than in Indian River, and teachers to fall in between. In Vero Beach (located in Indian River County), whether one works at Marquette Lumber's national headquarters in downtown Vero Beach (population 18,000) or at Profold, Inc., on the outskirts of Sebastian, or at a school anywhere does not much affect the cost of housing and commuting. In Palm Beach, in contrast, thousands of people commute ten or fifteen miles from inland Wellington, with its pleasant homes, goods schools, and soccer fields to work in West Palm Beach. If you teach at a school in Wellington, you can enjoy the amenities of that community without putting up with a long, congested commute. If you work downtown at J.P. Morgan Trust your pay might offset the expense of living in West Palm Beach or the trouble and expense of commuting from Wellington. If you are a nurse at the new hospital near Wellington, your salary need not include an extra amount to pay for commuting.

We present rough evidence of work location to back up our intuitive notion that teachers have urban density gradients that place them in our residential worker classification. Table 3.2 shows that, nationally, where teachers work roughly matches where children live as measured by size of metropolitan statistical area (MSA).

Table 3.2 Work Location of Teachers

Location	Children	Teachers
Non-MSA	20.6%	20.4%
100,000 to 249,999	6.4%	6.1%
250,000 to 499,999	11.0%	10.8%
500,000 to 999,999	11.9%	14.2%
1,000,000 to 2,499,999	25.0%	25.5%
2,500,000 to 4,999,999	13.6%	13.2%
5,000,000 and larger	11.4%	9.8%

Source: BEBR calculations of data from the March 2001 Current Population Survey.

Using data from the March 2001 Current Population Survey, one can show that in the year 2000, MSAs of 500,000 and larger were the work locations of 81% of computer systems analysts, 75% of engineers, and 74% of accountants and auditors. In contrast only 58% of mechanics, 56% of carpenters, 52% of non-precision machine operators, and 51% of fabricators and assemblers worked in MSAs that large. Teachers, at 63%, came between the two groups. Perhaps more relevant to how wages vary across cities, however, is the proportion of workers who, conditional on working in an MSA, have jobs in its central city. There the picture varies from the one portrayed by city size: the shares in the central cities are 42% for fabricators, 41% for non-precision machine operators and architects, 33% for carpenters, 32% for teachers, and 29% for engineers, mechanics, and computer analysts.

The most authoritative recent study of how intra-urban job location affects pay is an analysis of 1990 census data from Boston and from Minneapolis by Timothy and Wheaton (2001). Sorting the census partitions of each city into employment zones and into residential zones, they find that workers earn more in the larger employment zones. The effect is independent of whether the zones are downtown or suburban. Pay is as high in the largest suburban zones as in the central business district. As an alternative measure of employment concentration, they use average commuting time to the zone, finding that the wage premium for an extra ten minutes of roundtrip commuting ranges from one-fourth to half of the hourly wage. They note that this premium includes compensation for direct travel costs (gasoline, for example) as well as for time.

Timothy and Wheaton (2001) confirm their results for most job categories. In particular, it holds for local government employees. One group for which it fails is federal employees, who receive the same pay throughout Boston and throughout Minneapolis, no matter where they work in those cities. The federal government adjusts pay for variations in living costs across cities, but not within them. In that sense, federal workers resemble Florida's school districts, in that through the FPLI there is in effect adjustment for variations in the cost of living across counties, but not within them. That is, however, a finer adjustment than the federal government makes, at least for metropolitan areas containing more than one school district.

Timothy and Wheaton (2001) do not investigate the pay of teachers as a separate category, but they do consider women separately, finding that "women's wages clearly show a much stronger response to commuting time than those of men, with coefficients 1.5 to 2.5 times as large." They speculate that women are under more time pressure than men because of greater household responsibilities. Since most teachers are women, they may place more value than most workers on being able to work close to home, and their being able to teach at a nearby school may be highly valued. How this affects variations in pay across districts is unclear. As noted, districts have uniform pay schedules that do not include differences related to school location. Within a district, central city and residential schools pay the same. This may cause inefficiency in Florida's educational spending relative to that of the rest of the country, since an average teacher in Florida works in a very large school district. A similar inefficiency may be associated with school size. Florida has the largest average school size of any state in the nation, which probably boosts average commuting time for its teachers.

Given Florida's distinctive features, it would be useful to study commuting times, school location, and wages for its teachers. We cannot replicate the Timothy-Wheaton study for Florida's urban areas. As they note, "many metropolitan areas containing very large central city boundaries (such as Los Angeles or Tampa-St. Petersburg) have a limited appeal for empirical work." What would be possible is to locate schools in census zones and compare average commuting time to those zones to average commuting time for all workers in each county. One could use geocoding to estimate travel time from where each teacher lives to the school where she works, but teachers' residences are not available. In any event, neither approach is feasible within the budget of this project.

Other features of teaching besides location with respect to the central city also complicate empirical investigations of the relation between teachers' pay and other wages. Most teachers enjoy instructing students of high socio-economic status (SES), who are on average more polite or less threatening, learn more easily, and have other behavioral characteristics that closely match those of the majority of teachers. Other things the same, it is likely that most teachers prefer smaller classes, especially in low-SES environments, where large classes are more subject to behavior disruptive to learning. Finally, work rules may vary across districts, with teachers willing to accept lower pay in exchange for more planning periods, among other job amenities.

3.4.3 Characteristics of teachers.

Teachers also differ in systematic ways from other workers. The majority of teachers, according to data from the March 2001 Current Population Survey 74%, are women. They may be more likely to have children, even in comparison to other working women. Furthermore, teaching is an attractive career for women who leave work temporarily to care for children. Flyer and Rosen (1994) discuss the attractiveness of teaching for women who also want to raise a family: "… female teachers spent 42% more time out of the labor force than other female college graduates and well over twice that of male college graduates." They also find that teachers "do not suffer wage penalties for time spent out of the labor market, while other female college graduates (including female dominated nursing and administrative support staff occupations) take wage hits of roughly 9% for each year spent out of the market sector." Teachers might additionally be more likely to be trailing spouses, secondary earners whose spouses earn more than they do. These characteristics may cause teachers, more than most workers, to be influenced by the quality of schools when seeking jobs and to prefer large urban locations in which both spouses can find employment. That could weaken the positive relation between pay and city size. Alternatively it might be easier to find a job teaching in a small town than a job in most other professions.

Teachers may have more strongly localized preferences than other professionals. Intuitively, people who teach are returning to a known work environment, the one in which they went to school. Perhaps such people are also likely to have a stronger-than-average preference to return to where they grew up. Faculty of the University of Florida's College of Education note anecdotally that graduates are quite likely to return to their hometowns, perhaps working as a bank teller until a teaching position becomes available. Such speculation, however, requires empirical confirmation. If true, the effect may be to make markets for teachers more local than markets for other professionals, and thus less subject to the usual causes of variations in wages across cities.

Finally, teachers, as college graduates professionally drawn to education, may be more attracted than most to urban environments. Alternatively, as parents, they may favor suburban settings. This issue is also empirical.

3.4.4 Tests using national data.

The upshot of the preceding discussion is that whether an amenity-adjusted price level index based on wage data represents teachers' salaries is an empirical issue. A straightforward test is to construct a wage index for teachers and then regress it on a general wage index. This is analogous to a method used for testing whether property appraisals are unbiased by regressing actual sale prices on appraised values. The form of the test for teachers' wages is:

$$TEACHSAL_i = \alpha + \beta\ INDEX_i + \varepsilon_i \qquad (3.2)$$

where $TEACHSAL_i$ is the logarithm of an index of teachers' salaries in the i^{th} MSA, $INDEX_i$ is the logarithm of a general index of wages in MSA i, and ε_i is an error term for MSA i. We construct the indexes from occupational wage data for the year from all MSAs and available from the U.S. Bureau of Labor Statistics. The question can be stated thus: "Is the general wage index an unbiased predictor of teachers' salaries?" Formally, the null hypothesis to be tested is that $\alpha = 0$ and $\beta = 1$.

The chief surprise from implementation of the test is how close the results are to the null. That is, there is no evidence that a general wage index is other than an unbiased predictor of teachers' salaries. The result of estimating equation (3.2) is:

$$TEACHSAL_i = \underset{(0.749)}{-0.142} + \underset{(0.071)}{1.011}\ INDEX_i \qquad (3.3)$$

$R^2 = 0.46$

Observations: 242 Metropolitan Statistical Areas

Estimated standard errors are in parentheses. Remarkably, the estimated constant term is within a fifth of a standard error of zero and the estimated coefficient of INDEX is within a sixth of a standard error of one.

That would be the end of the story if equation 3.3 explained close to 100% of the variance of teachers' salaries across MSAs, but it explains only 46%. That is, approximately half of the variance is unexplained by equation 3.3. But, in fact, this is very much in line with the variance of wages for other occupations that is explained by the wage index, when the procedure is replicated for all occupations in the BLS data for which a mean is observed in most MSAs. Thus, both in terms of unbiasedness, and in terms of explanatory power, the wage index appears to be as good a predictor of teacher salaries as it is of the salaries of any other occupation. Since the level of prices of goods and services is only one factor which determines wages, the necessary conclusion is that an index based on wage data from a broad labor market is a better index of school labor costs than one based on the costs of goods and services alone.

Part of the remaining variance is due to aggregation approximations and measurement error in construction of the indexes for teachers' salaries and for wages in general. It is likely that much of it, however, is due to the differences between the markets for teachers and for other workers, described above. Among the more likely candidates for being important differences are unionization and teachers' preferences for school-specific amenities such as congenial students and small classes. To illustrate this point, we modify equation 3.3 by adding $POVERTY_i$, the poverty rate for MSA i, to the right-hand side, and re-estimate it. The result is:

$$TEACHSAL_i = \underset{(0.837)}{-1.955} + \underset{(0.071)}{1.204}\ INDEX_i + \underset{(0.020)}{0.088}\ POVERTY_i \qquad (3.4)$$

$R^2 = 0.50$

Observations: 242 Metropolitan Statistical Areas

The estimated coefficient of POVERTY is positive, as expected, and significant both statistically and economically. Teachers who instruct more poor children are paid more, other things the same. Importantly, equation (3.4) rejects the hypothesis that the general wage index is an unbiased predictor of teachers' salaries. The constant term is significantly negative and the estimated coefficient of INDEX significantly exceeds one. Controlling for the poverty rate, a 10% higher general wage index is associated with 12% higher teachers' salaries.

Without controlling for other omitted variables, however, it is difficult to know what to make of the finding that the coefficient changed. Put differently, on its own, the wage index was an unbiased predictor of average teacher salaries, given the overall characteristics of a city and the way those characteristics effect most occupations. However, for individual occupations, particular factors will have idiosyncratic effects. Since some of these variables will be correlated with the original index, the inclusion of some but not all of them in a regression will alter the estimated coefficient. But we don't know what the effect on the coefficient would be if all such variables were included.

Another problem is that the poverty rate itself has not been adjusted for spatial variation in the price level, and is therefore measured with an error that is positively correlated with the wage index. This means that an increase in the wage index, holding measured poverty constant, actually corresponds to an increase in poverty, and, teacher salaries must compensate for the increased cost of living and the increased real poverty. This means that no real interpretation can be directly attached to the fact that the coefficient on the wage index in equation 3.4 is above 1.00. Given the fact that both amenities and the price level are important determinants of wages, an amenity-adjusted index based on wage data is still likely better than an average price level index not adjusted for amenities.

We also investigate whether the tendency for teacher's employment to be non-centrally located affects the applicability of a wage index. To do this, we first gather data on employment for a large number of occupations in the 11 multi-county MSAs in Florida and Ohio, two states in which the needed data were readily available at the county level from the OES. For these occupations, we calculate the average fraction of employment in the central MSA county(s), where we take central to mean that the county contained a city whose name appeared in the MSA name. We take this as an indicator of the relative centrality of the occupations. We are able to construct such a measure for 167 occupations. Summary statistics and results for school related occupations with the needed data in the data set are recorded in Table 3.3. The fraction of school related employment in central counties is 1.33 standard deviations below the average, indicating teachers are relatively dispersed. This would indicate that teachers should tend to under adjust to differences in the price level.

Table 3.3 Centrality of School Related Employment

SOC Title	SOC Code	Fraction Central
Education Administrators, Elementary and Secondary School	119032	0.6895
Preschool Teachers, Except Special Education	252011	0.7543
Kindergarten Teachers, Except Special Education	252012	0.7302
Elementary School Teachers, Except Special Education	252021	0.7361
Middle School Teachers, Except Special and Vocational	252022	0.7107
Vocational Education Teachers, Secondary School	252032	0.6592
Teacher Assistants	259041	0.7074
Average of Available School Related Occupations	NA	0.7125
Average (167 Occupations)	NA	0.7802
Standard Deviation (167 Occupations)	NA	0.051
Median (167 Occupations)	NA	0.7795

To test this, we need an indicator of the MSA price level. Since the population of the city largely drives land prices, we use MSA population to proxy the price level. We then regress the log of occupation and city specific average wages on a city dummy, an occupation dummy, and a variable interacting our centrality indicator with the log of population. The regression is based on 38,814 observed average wages for these 167 occupations in 332 MSAs. The hypothesis is that the coefficient on the interaction term will be positive, indicating that the adjustment for the price level increases with the centrality of the occupation. The estimated coefficient is 0.208, with a standard error of 0.01. Thus, there is statistically and economically significant evidence that more central occupations will adjust more strongly to variation in the cost of living. This implies that wages of teaching, a less centrally located profession, will adjust with the price level somewhat less strongly than wages of more centrally located occupations. We will adapt this finding, re-estimated based on Florida data, to adjust the average wage index to make it more applicable for Florida's school personnel in the following section.

3.5 Calculating an Amenity Adjusted FPLI

3.5.1 Initial estimation.

Having made the argument that it would be best to have an amenity-adjusted FPLI upon which to base funding decisions, how do we actually calculate such an index? To fix ideas, it is helpful to be a bit more formal about the relationship between wages, occupations, the prices of goods and services, and the level of amenities. If we let c index counties and i index occupations, the basic notion is that, as a good approximation, the average wage required to make county c as desirable to workers in occupation i as any other county will be the product of a base wage level for that occupation, the county's price level, and an amenity adjustment. Observed wages will be equal to that amount, but for a random error. Using subscripts to denote city and occupation, this may be expressed as:

$$\text{Mean\_Wage}_{ic} = \text{Base\_Wage}_{i} \times \text{Price\_Factor}_{c} \times \text{Amenity\_Factor}_{c} \times \text{Error}_{ic} \qquad (3.5)$$

Given this formulation, we may then regress the log of mean wages on county and occupation categorical variables. This amounts to calculating a weighted average of the ratios of each county's wage for each occupation to the state average for that occupation. The reason we use regression techniques instead of calculating the weighted average is because we observe means for more occupations in some counties than in others, and the regression technique can deal with this unbalanced data. The estimated coefficient on the set of county categorical variables then is an estimate of the log of the product of the price and amenity factors – that is, the exponentiated values of those coefficients *are* an amenity-adjusted price level index. To distinguish between the two indexes, we will refer to the unadjusted index as FPLI_U (for unadjusted) and the amenity adjusted index as FPLI_A (for adjusted). To perform the regression, we first dropped occupations that appeared in fewer than 10 counties. We perform a weighted regression, using employment in each occupation and county as weights, since the size of the sample in each county and occupation cell will be closely related to the sample size for that cell (we do not have exact sample sizes).

The results of the regression are presented in Table 3.4. Only the county dummy coefficient, fit, and sample size statistics are reported in the table; since the occupation dummies are of no interest beyond their roles as controls, their coefficients are omitted. Rather than omitting one county dummy variable and one occupation dummy variable, we omit the constant and one occupation variable. This has no effect on the results, and is done only to ease interpretation and calculation of all 67 standard errors. Thus, the coefficient is the log of the product of the county amenity-adjusted price index and the base wage for the omitted occupation. Exponentiating the county coefficients and then dividing by the population-weighted mean of those exponentiated values produces the amenity-adjusted index presented in the last column. The fourth column presents the number of observations in the regression for each county. There are 29,495 total observations, for an average of 440 per county. Glades County is based on the smallest sample, 111 occupation means, and Hillsborough County is based on the largest sample, 702 occupation means.

Table 3.4 Regression Results

Variable	Coefficient	Standard Error	Observations	FPLI_A
Alachua	11.6510	0.0142	639	98.90
Baker	11.6016	0.0285	222	94.13
Bay	11.5927	0.0151	611	93.30
Bradford	11.5916	0.0253	287	93.19
Brevard	11.6487	0.0139	663	98.67
Broward	11.7109	0.0134	700	105.00
Calhoun	11.4920	0.0354	223	84.37
Charlotte	11.6130	0.0160	510	95.21
Citrus	11.5875	0.0172	462	92.82
Clay	11.6508	0.0162	474	98.88
Collier	11.7375	0.0143	605	107.84
Columbia	11.5598	0.0184	443	90.28
Miami-Dade	11.6740	0.0136	661	101.20
De Soto	11.5522	0.0246	298	89.60
Dixie	11.5311	0.0347	142	87.72
Duval	11.6926	0.0135	684	103.10
Escambia	11.5959	0.0142	656	93.60
Flagler	11.5802	0.0206	372	92.14
Franklin	11.6101	0.0344	191	94.93
Gadsden	11.5842	0.0213	368	92.51
Gilchrist	11.5172	0.0418	157	86.52
Glades	11.6373	0.0578	111	97.56
Gulf	11.5328	0.0337	226	87.87
Hamilton	11.5907	0.0287	213	93.11
Hardee	11.5599	0.0256	271	90.29
Hendry	11.5683	0.0231	335	91.05
Hernando	11.5660	0.0167	421	90.84
Highlands	11.5346	0.0185	452	88.03
Hillsborough	11.6724	0.0134	702	101.04
Holmes	11.5236	0.0326	230	87.07
Indian River	11.6316	0.0157	559	97.00
Jackson	11.5268	0.0203	417	87.35
Jefferson	11.4984	0.0335	203	84.90
Lafayette	11.4551	0.0502	146	81.31
Lake	11.6535	0.0149	553	99.15
Lee	11.6697	0.0139	656	100.76

Continued…

Table 3.4: Regression Results (Continued)

Variable	Coefficient	Standard Error	Observations	FPLI_A
Leon	11.7000	0.0140	633	103.87
Levy	11.5241	0.0242	311	87.11
Liberty	11.5089	0.0459	166	85.80
Madison	11.5863	0.0318	243	92.71
Manatee	11.6257	0.0143	597	96.43
Marion	11.6082	0.0146	607	94.75
Martin	11.6665	0.0154	557	100.44
Monroe	11.7089	0.0162	502	104.80
Nassau	11.6620	0.0204	332	99.99
Okaloosa	11.5960	0.0147	605	93.60
Okeechobee	11.5702	0.0229	330	91.22
Orange	11.6760	0.0134	698	101.40
Osceola	11.6341	0.0153	476	97.24
Palm Beach	11.7191	0.0134	698	105.87
Pasco	11.5965	0.0146	544	93.65
Pinellas	11.6682	0.0135	686	100.62
Polk	11.6442	0.0138	670	98.23
Putnam	11.6248	0.0190	454	96.34
St. Johns	11.6439	0.0160	499	98.20
St. Lucie	11.6458	0.0153	576	98.38
Santa Rosa	11.6026	0.0169	477	94.23
Sarasota	11.6495	0.0139	626	98.75
Seminole	11.6583	0.0141	593	99.63
Sumter	11.6055	0.0242	305	94.50
Suwannee	11.5543	0.0224	331	89.78
Taylor	11.5694	0.0257	316	91.15
Union	11.6250	0.0325	177	96.36
Volusia	11.6124	0.0140	660	95.16
Wakulla	11.5953	0.0299	270	93.54
Walton	11.5590	0.0213	385	90.20
Washington	11.5839	0.0264	308	92.48
Observations	29495			
R-Squared	0.9999			
Root MSE	0.1205			

As calculated, FPLI_A is, of course, prone to some degree of statistical inaccuracy. The error term indicates that the estimated coefficients embody some degree of statistical uncertainty. This may be particularly true in small counties where a single employer paying above market wages may considerably inflate the measured average, or the closing of a single large firm may temporarily depress wages below the long-term market level. In addition, findings in section 3.4 above indicated that teachers tend to adjust less than one-to-one with average wages when employment density is accounted for. We take three additional steps to address these issues. First, we smooth some of the statistical variation using a version of a shrinkage estimator, where the shrinkage is toward a regression estimated conditional mean. Second, we apply an occupational density adjustment. Third, we apply geographic smoothing, based upon recognized principles of spatial urban and transportation economics.

3.5.2 Statistical smoothing.

The standard errors of the coefficients from the regression that produced FPLI_A provide a county-by-county measure of the degree of this uncertainty. It is likely that the coefficients will be less exactly estimated in the smaller counties. Since prevailing wages are likely to be closely correlated with a number of observable variables, including the FPLI_U, we regress the log of FPLI_A on a vector of explanatory variables. From this regression, we obtain predicted values for the log of FPLI_A and estimate the standard error of the predicted value for each county. It is then possible to form an estimate of an amenity-adjusted price index that is closer to the actual, but unobserved, value by combining the observed index value, which is measured only imperfectly, and the predicted index, which is predicted only imperfectly. We choose weights for each estimate so as to minimize the expected squared log difference between them – that is we choose the weights to minimize the mean squared error for each county. The optimal weight to place on the predicted value is equal to the ratio of the variance of the log of the measured FPLI_A to the sum of the variances of the measured and predicted values. The remaining weight is placed on the measured value.

To generate the predicted value, FPLI_A was regressed on FPLI_U, a measure of the FPLI_A in surrounding counties, called NEARFPLI_A, population (POP), the product of these two, POPNEARFPLI_A, and the fraction of the population 65 and over, RETIRE, with all values in log form. Values of FPLI_A in nearby counties are important because the fact that workers can commute across county lines ensures wages cannot be too different between nearby counties. NEARFPLI is constructed for each county by taking a weighted average of the log of FPLI_A of every county of Florida, where the relative weight placed on each value is inversely proportional to the distance between the population centers of the counties (but scaled to sum to one). We interact NEARFPLI_A with population because this effect will matter greatly for small counties, but not so much for large counties. The fraction of the population of retirement age is included because retirees may be differentially drawn to high amenity areas since the wage reduction due to the presence of high amenities will not affect them, thus this variable may be a proxy of amenity levels. With variables in logs, the regression equation is, then:

$$\begin{aligned} FPLI\_A = \beta_0 + \beta_1 FPLI\_U + \beta_2 NEARFPLI\_A + \beta_3 POP \\ + \beta_4 POPNEARFPLI\_A + B_5 RETIRE + ERROR \end{aligned} \quad (3.6)$$

The error term in equation may be thought of as consisting of two components. First, FPLI_A is intended to represent an underlying amenity adjusted-price level index, but it is measured with error, hence, there is a pure dependent variable measurement error in the error term of equation (3.6). Additionally, the specification on the right hand side of equation 3.6 is unlikely to be a perfect approximation of the true underlying amenity adjusted index, hence there is some degree of modeling error. Assuming the two sources of error are independent, the variance of the error term in equation (3.6), denoted $VARIANCE_{TOTAL}$, will be the sum of two components, one due to measurement error, denoted $VARIANCE_{MEASURE}$, and one due to the imperfection of the modeling approximation, $VARIANCE_{MODEL}$, so that:

$$VARIANCE_{TOTAL} = VARIANCE_{MEASURE} + VARIANCE_{MODEL} . \quad (3.7)$$

The analysis proceeds from here in four steps. First, we perform an ordinary least squares regression. From this regression, we use the squared regression residuals as estimates of $VARIANCE_{TOTAL}$. In the second step, the variances of the coefficients from the regression from which FPLI_A is derived are used as an estimate of $VARIANCE_{MEASURE}$, which is subtracted from our estimate of $VARIANCE_{TOTAL}$ to arrive at an estimate of $VARIANCE_{MODEL}$. The mean of $VARIANCE_{MODEL}$ is .000504. We regress our estimate of $VARIANCE_{MODEL}$ on population, trying several functional forms to investigate whether or not $VARIANCE_{MODEL}$ varies systematically with the county size. We find that it does not, and adopt the mean as our estimate of $VARIANCE_{MODEL}$ for all observations. This gives:

$$VARIANCE_{TOTAL} = VARIANCE_{MEASURE} + .000504 . \quad (3.8)$$

In the third step, we perform a weighted least squares estimation of equation (3.6), where the weights are inversely proportional to the square root of our estimate of $VARIANCE_{TOTAL}$. These results are recorded in Table 3.5. The explanatory variables chosen explain 71% of the variation in FPLI_A, and all are statistically significant with the expected signs (except for POP, which was included merely as a control given it is also interacted with NEAR_FPLI_A).

Table 3.5: Regression Results for
Conditional Mean of FPLI_A

Variable	Coefficient	Standard Error
FPLI_U	0.7890	0.1772
NEARFPLI_A	4.6031	2.2676
POP	-0.0021	0.0119
POPNEARFPLI_A	-0.3755	0.1998
RETIRE	-0.0253	0.0106
Constant	-3.6574	0.7688
Observations	67	
R-Squared	0.707	
Root MSE	0.032	

The final step is to use FPLI_A and its predicted values to arrive at a statistically smoothed estimate of the amenity adjusted price level index. Table 3.6 presents these calculations and results. Since FPLI_U is heavily weighted in the predicted value, the smoothed index is a weighted average of FPLI_A and FPLI_U.

Table 3.6 Statistical Smoothing of FPLI_A

County	Log FPLI_A	VARIANCE (MEASURE)	Predicted Log FPLI_A	Weight On Predicted Value	Statistically Smoothed Log FPLI_A	Statistically Smoothed FPLI_A
Alachua	-0.0101	0.000202	-0.0143	0.2856	-0.0113	98.65
Baker	-0.0596	0.000810	-0.0762	0.6165	-0.0698	93.04
Bay	-0.0685	0.000227	-0.0467	0.3101	-0.0617	93.80
Bradford	-0.0696	0.000641	-0.0732	0.5596	-0.0716	92.87
Brevard	-0.0124	0.000192	-0.0137	0.2760	-0.0128	98.50
Broward	0.0497	0.000179	0.0546	0.2618	0.0510	104.99
Calhoun	-0.1691	0.001253	-0.1398	0.7131	-0.1482	86.02
Charlotte	-0.0481	0.000257	-0.0485	0.3372	-0.0483	95.07
Citrus	-0.0736	0.000295	-0.0775	0.3691	-0.0751	92.55
Clay	-0.0103	0.000263	-0.0294	0.3425	-0.0168	98.10
Collier	0.0764	0.000203	0.0137	0.2873	0.0584	105.76
Columbia	-0.1013	0.000338	-0.0737	0.4011	-0.0902	91.16
Miami-Dade	0.0129	0.000184	0.0728	0.2675	0.0289	102.69
De Soto	-0.1089	0.000603	-0.0634	0.5446	-0.0842	91.71
Dixie	-0.1300	0.001206	-0.1113	0.7052	-0.1168	88.76
Duval	0.0314	0.000181	0.0065	0.2643	0.0248	102.27
Escambia	-0.0652	0.000201	-0.0265	0.2850	-0.0542	94.51
Flagler	-0.0809	0.000422	-0.0679	0.4558	-0.0750	92.56
Franklin	-0.0511	0.001182	-0.1297	0.7010	-0.1062	89.71
Gadsden	-0.0770	0.000455	-0.0748	0.4743	-0.0759	92.47
Gilchrist	-0.1439	0.001749	-0.1046	0.7762	-0.1134	89.07
Glades	-0.0238	0.003344	-0.0811	0.8690	-0.0736	92.68
Gulf	-0.1283	0.001139	-0.1085	0.6931	-0.1146	88.96
Hamilton	-0.0704	0.000825	-0.1092	0.6206	-0.0945	90.77
Hardee	-0.1012	0.000656	-0.0814	0.5655	-0.0900	91.18
Hendry	-0.0928	0.000532	-0.0357	0.5134	-0.0635	93.63
Hernando	-0.0951	0.000280	-0.0656	0.3571	-0.0846	91.67
Highlands	-0.1265	0.000341	-0.0822	0.4032	-0.1087	89.49
Hillsborough	0.0112	0.000179	0.0216	0.2625	0.0140	101.17
Holmes	-0.1375	0.001061	-0.1249	0.6780	-0.1290	87.69
Indian River	-0.0295	0.000248	-0.0530	0.3295	-0.0373	96.12
Jackson	-0.1344	0.000413	-0.0925	0.4505	-0.1155	88.88
Jefferson	-0.1628	0.001120	-0.1077	0.6896	-0.1248	88.06
Lafayette	-0.2060	0.002524	-0.1354	0.8335	-0.1472	86.11

Continued…

Table 3.6 Statistical Smoothing of FPLI_A (Continued)

County	Log FPLI_A	VARIANCE (MEASURE)	Predicted Log FPLI_A	Weight On Predicted Value	Statistically Smoothed Log FPLI_A	Statistically Smoothed FPLI_A
Lake	-0.0076	0.000223	-0.0517	0.3067	-0.0211	97.68
Lee	0.0085	0.000192	-0.0195	0.2762	0.0008	99.85
Leon	0.0389	0.000197	-0.0075	0.2806	0.0259	102.38
Levy	-0.1371	0.000584	-0.0976	0.5366	-0.1159	88.85
Liberty	-0.1523	0.002108	-0.1392	0.8070	-0.1417	86.58
Madison	-0.0748	0.001010	-0.1120	0.6671	-0.0996	90.31
Manatee	-0.0354	0.000205	-0.0296	0.2894	-0.0338	96.45
Marion	-0.0530	0.000213	-0.0499	0.2967	-0.0521	94.71
Martin	0.0053	0.000238	-0.0261	0.3206	-0.0047	99.29
Monroe	0.0478	0.000261	0.0571	0.3410	0.0510	104.98
Nassau	0.0009	0.000418	-0.0531	0.4533	-0.0236	97.44
Okaloosa	-0.0652	0.000217	-0.0357	0.3012	-0.0563	94.31
Okeechobee	-0.0909	0.000524	-0.0570	0.5096	-0.0736	92.68
Orange	0.0149	0.000179	0.0072	0.2624	0.0128	101.06
Osceola	-0.0270	0.000233	-0.0267	0.3158	-0.0269	97.11
Palm Beach	0.0580	0.000181	0.0353	0.2637	0.0520	105.09
Pasco	-0.0646	0.000214	-0.0396	0.2979	-0.0572	94.22
Pinellas	0.0071	0.000181	0.0142	0.2642	0.0090	100.66
Polk	-0.0169	0.000191	-0.0302	0.2751	-0.0206	97.74
Putnam	-0.0364	0.000359	-0.0747	0.4161	-0.0523	94.68
St. Johns	-0.0172	0.000256	-0.0274	0.3369	-0.0206	97.73
St. Lucie	-0.0154	0.000234	-0.0339	0.3167	-0.0212	97.67
Santa Rosa	-0.0585	0.000287	-0.0466	0.3627	-0.0542	94.50
Sarasota	-0.0116	0.000192	-0.0259	0.2759	-0.0156	98.22
Seminole	-0.0028	0.000199	-0.0053	0.2831	-0.0035	99.42
Sumter	-0.0557	0.000587	-0.0704	0.5380	-0.0636	93.62
Suwannee	-0.1069	0.000504	-0.1079	0.4999	-0.1074	89.61
Taylor	-0.0917	0.000660	-0.1006	0.5669	-0.0967	90.57
Union	-0.0361	0.001054	-0.0969	0.6764	-0.0772	92.35
Volusia	-0.0487	0.000196	-0.0070	0.2801	-0.0370	96.14
Wakulla	-0.0659	0.000893	-0.0923	0.6391	-0.0828	91.84
Walton	-0.1022	0.000452	-0.0920	0.4726	-0.0974	90.51
Washington	-0.0772	0.000699	-0.1269	0.5810	-0.1061	89.73

3.5.3 Occupational density gradient adjustment.

Section 3.4.5 presented evidence that occupations that are relatively decentralized adjust less than one for one to changes in the price level. Since teachers are less centralized than the average occupation, this may mean that an average amenity-adjusted price level index will over state variation in wages needed to compensate school personnel for differences in amenities and the cost of living. In this section, we construct an appropriate adjustment for this effect.

Our work differs from that of section 3.4.5 in two ways. First, while in the national test we relied on population to proxy the cost of living, for the counties of Florida we have a direct measure, namely, FPLI_U. Second, FPLI_A is estimated based on all occupations in the OES dataset from LMI for Florida's counties, while we have a measure of the centrality of occupational locations for only 167 occupations. Therefore, we start with the smoothed version of FPLI_A and calculate an adjustment to reflect the effect of occupational centrality on the price factor component of the adjustment. Letting CENTRAL represent the measure of occupation location, and CENTRAL_Log_FPLI_U be the interaction of the log of FPLI_U (2003) and CENTRAL, we form the following regression equation:

$$\begin{aligned}&Log\_Wage - Log\_FPLI\_A = \beta_0 + \beta_1 Log\_FPLI\_U + \beta_2 CENTRAL\_Log\_FPLI\_U \\ &+ Occupation\_Specific\_Effect + Error \qquad (3.9)\end{aligned}$$

We perform weighted least-squares, using weights inversely proportional to the square root of employment in each occupation in each county, as was done in the original estimation of FPLI_A. Results are recorded in Table 3.7. The results are as expected, more central occupations adjust more strongly to the cost of living.

Table 3.7 Florida Centrality Effect Regression

Variable	Coefficient	Standard Error
Log_FPLI_U	-3.3163	0.4308
CENTRAL_Log_FPLI_U	4.2032	0.5532
Constant	10.2304	0.0009
Observations	10124	
R-Squared	0.962	
Root MSE	0.09252	

Noting from Table 3.3 that the average value of CENTRAL for teachers is 0.7125, we proceed then by adding (4.2032 x 0.7125 – 3.3163) x Log_FPLI_U (using the 2003 FPLI_U), or, -0.3216 x Log_FPLI_U to the log of FPLI_A (using the smoothed log of FPLI_A). Exponentiating and dividing by the state average gives a further smoothed FPLI_A. These calculations are contained in Table 3.8.

Table 3.8 Occupational Centrality Adjustment of FPLI_A

County	Statistically Smoothed Log FPLI_A	Log FPLI_U (2003)	Adjusted Statistically Smoothed Log FPLI_A	Adjusted Statistically Smoothed FPLI_A
Alachua	-0.0113	-0.0339	-0.0004	99.73
Baker	-0.0698	-0.0560	-0.0518	94.73
Bay	-0.0617	-0.0489	-0.0460	95.29
Bradford	-0.0716	-0.0456	-0.0569	94.25
Brevard	-0.0128	-0.0246	-0.0049	99.29
Broward	0.0510	0.0525	0.0341	103.24
Calhoun	-0.1482	-0.0748	-0.1242	88.12
Charlotte	-0.0483	-0.0277	-0.0394	95.92
Citrus	-0.0751	-0.0574	-0.0566	94.28
Clay	-0.0168	-0.0408	-0.0037	99.40
Collier	0.0584	0.0300	0.0487	104.75
Columbia	-0.0902	-0.0569	-0.0719	92.85
Miami-Dade	0.0289	0.0636	0.0084	100.62
De Soto	-0.0842	-0.0338	-0.0733	92.72
Dixie	-0.1168	-0.0427	-0.1031	90.00
Duval	0.0248	-0.0286	0.0340	103.23
Escambia	-0.0542	-0.0471	-0.0390	95.95
Flagler	-0.0750	-0.0354	-0.0636	93.62
Franklin	-0.1062	-0.0464	-0.0913	91.07
Gadsden	-0.0759	-0.0511	-0.0595	94.01
Gilchrist	-0.1134	-0.0529	-0.0964	90.60
Glades	-0.0736	-0.0309	-0.0637	93.61
Gulf	-0.1146	-0.0470	-0.0995	90.32
Hamilton	-0.0945	-0.0596	-0.0753	92.53
Hardee	-0.0900	-0.0582	-0.0713	92.91
Hendry	-0.0635	-0.0276	-0.0546	94.47
Hernando	-0.0846	-0.0473	-0.0694	93.08
Highlands	-0.1087	-0.0563	-0.0906	91.13
Hillsborough	0.0140	-0.0085	0.0167	101.45
Holmes	-0.1290	-0.0710	-0.1062	89.72
Indian River	-0.0373	-0.0340	-0.0263	97.18
Jackson	-0.1155	-0.0651	-0.0946	90.77
Jefferson	-0.1248	-0.0550	-0.1071	89.64
Lafayette	-0.1472	-0.0703	-0.1246	88.09

Continued…

Table 3.8 Occupational Centrality Adjustment of FPLI_A (Continued)

County	Statistically Smoothed Log FPLI_A	Log FPLI_U (2003)	Adjusted Statistically Smoothed Log FPLI_A	Adjusted Statistically Smoothed FPLI_A
Lake	-0.0211	-0.0433	-0.0072	99.06
Lee	0.0008	-0.0205	0.0074	100.51
Leon	0.0259	-0.0337	0.0367	103.50
Levy	-0.1159	-0.0604	-0.0965	90.60
Liberty	-0.1417	-0.0632	-0.1214	88.37
Madison	-0.0996	-0.0620	-0.0797	92.13
Manatee	-0.0338	-0.0216	-0.0268	97.13
Marion	-0.0521	-0.0501	-0.0359	96.25
Martin	-0.0047	-0.0036	-0.0036	99.42
Monroe	0.0510	0.0918	0.0215	101.94
Nassau	-0.0236	-0.0478	-0.0082	98.95
Okaloosa	-0.0563	-0.0478	-0.0409	95.77
Okeechobee	-0.0736	-0.0331	-0.0630	93.68
Orange	0.0128	-0.0260	0.0212	101.91
Osceola	-0.0269	-0.0331	-0.0163	98.16
Palm Beach	0.0520	0.0359	0.0405	103.89
Pasco	-0.0572	-0.0351	-0.0459	95.30
Pinellas	0.0090	0.0047	0.0074	100.52
Polk	-0.0206	-0.0436	-0.0065	99.12
Putnam	-0.0523	-0.0591	-0.0333	96.50
Saint Johns	-0.0206	-0.0181	-0.0148	98.30
Saint Lucie	-0.0212	-0.0278	-0.0123	98.55
Santa Rosa	-0.0542	-0.0504	-0.0380	96.05
Sarasota	-0.0156	-0.0155	-0.0106	98.72
Seminole	-0.0035	-0.0267	0.0051	100.28
Sumter	-0.0636	-0.0472	-0.0484	95.06
Suwannee	-0.1074	-0.0679	-0.0856	91.59
Taylor	-0.0967	-0.0450	-0.0823	91.89
Union	-0.0772	-0.0627	-0.0571	94.24
Volusia	-0.0370	-0.0089	-0.0342	96.42
Wakulla	-0.0828	-0.0534	-0.0656	93.44
Walton	-0.0974	-0.0537	-0.0801	92.09
Washington	-0.1061	-0.0656	-0.0850	91.65

3.5.5 Geographic smoothing.

A finding that has become a stylized fact among transportation and urban economists is that the value of time spent in commuting is valued at about half the before tax wage rate (Small and Winston, 1999). We exploit this to note that the wage in small counties should be no less than the highest available commute time-adjusted urban county wage. If we let S denote a small county, L denote a large county (one with a city which lends its name to one of Florida's MSAs), and t denote extra time spent commuting by residents of the small county if they worked in the large county, relative to the commute times of those who live and work in the large county, this implies that:

$$8 \cdot FPLI\_A_S \geq \left(8 - \frac{t}{2}\right) \cdot FPLI\_A_L \qquad (3.10)$$

Letting d denote the distance between the population centers of each county, f denote the fraction of that distance that represents travel time to the large county from the small county that is in excess of what workers in the large county have to spend commuting themselves, and s denote the average speed over that portion of the commute, and assuming a two way commute each day, equation 3.10 can be rewritten as:

$$FPLI\_A_S \geq \left(1 - \frac{f \cdot d}{8 \cdot s}\right) \cdot FPLI\_A_L \qquad (3.11)$$

We use equation 3.11 to smooth FPLI_A assuming that f is 50% and s is 50 miles per hour.[7] Since the smallest two-thirds (in population) of Florida's counties comprise only 16.2% of its population, imposing such a constraint has very little effect on the large counties but improves accuracy for the smaller counties, and also reduces the variation of the FPLI_A. This adjustment, while appropriate for amenity-adjusted cost of living

[7] These are chosen because they seem like reasonable approximations. They could be improved if a separate study was funded to investigate more exact values, but we do not expect large changes in the final results.

indexes, is not appropriate for cost of living indexes that are not adjusted for amenity differences, since there is no such geographic constraint on raw cost levels. While 35 districts are affected by this adjustment, they comprise only 11.23% of the state's population, and the average change for these counties is only 2.43. Final results are presented below.

3.6 Amenity-Adjusted FPLI: Results and Effect

Having chosen FPLI_A to denote the amenity adjusted FPLI, we choose FPLI_AS to denote the smoothed amenity-adjusted FPLI. Table 3.9 presents the three-year average of FPLI_U for 2001 to 2003, the 2003 FPLI_AS, calculated as described above, and the change in the DCD that would occur if its basis were switched to FPLI_AS.

Table 3.9 Alternative Indexes

County	FPLI_U	Rank	FPLI_AS	Rank	Change In DCD	Rank
Alachua	95.20	32	99.46	15	0.0341	11
Baker	93.14	51	97.58	29	0.0355	8
Bay	93.64	43	95.03	51	0.0111	41
Bradford	93.58	45	97.01	31	0.0274	16
Brevard	96.46	18	99.02	21	0.0205	23
Broward	106.37	3	102.96	4	-0.0273	65
Calhoun	91.13	65	95.55	47	0.0354	9
Charlotte	95.39	29	95.66	46	0.0022	50
Citrus	92.50	58	94.03	57	0.0122	38
Clay	94.71	33	99.63	13	0.0394	5
Collier	102.53	5	104.47	1	0.0155	32
Columbia	92.05	60	93.97	58	0.0154	34
Miami-Dade	107.64	2	100.34	9	-0.0584	66
De Soto	95.86	26	96.19	38	0.0026	49
Dixie	93.32	48	92.98	62	-0.0027	54
Duval	96.46	18	102.95	5	0.0519	2
Escambia	93.74	41	95.69	45	0.0156	31
Flagler	95.90	25	94.54	55	-0.0109	63
Franklin	95.53	28	95.02	52	-0.0041	57
Gadsden	93.80	40	99.42	16	0.0450	3
Gilchrist	92.54	57	95.13	50	0.0207	22
Glades	96.51	17	97.37	30	0.0069	45
Gulf	93.59	44	93.24	60	-0.0028	55
Hamilton	91.13	65	92.28	63	0.0092	44
Hardee	93.54	46	94.90	54	0.0109	42
Hendry	97.30	12	99.08	20	0.0142	35
Hernando	93.22	49	96.28	36	0.0245	20
Highlands	93.69	42	93.71	59	0.0002	52
Hillsborough	99.52	7	101.18	8	0.0133	36
Holmes	91.54	64	90.30	67	-0.0099	62
Indian River	96.13	23	96.91	32	0.0062	46
Jackson	91.08	67	94.46	56	0.0270	18
Jefferson	94.56	35	99.15	18	0.0367	7
Lafayette	91.64	63	93.13	61	0.0119	40

Continued…

Table 3.9:- Alternative Indexes (Continued)

County	FPLI_U	Rank	FPLI_AS	Rank	Change In DCD	Rank
Lake	95.33	31	98.79	23	0.0277	15
Lee	97.78	11	100.24	10	0.0197	25
Leon	96.42	20	103.22	3	0.0544	1
Levy	92.87	56	94.98	53	0.0169	27
Liberty	92.98	54	96.77	34	0.0303	13
Madison	93.34	47	95.78	44	0.0195	26
Manatee	97.89	10	96.87	33	-0.0082	59
Marion	94.01	38	95.99	40	0.0158	29
Martin	98.44	9	99.15	18	0.0057	47
Monroe	111.23	1	101.66	6	-0.0766	67
Nassau	94.10	37	99.23	17	0.0410	4
Okaloosa	93.91	39	95.51	48	0.0128	37
Okeechobee	95.98	24	96.50	35	0.0042	48
Orange	97.28	13	101.63	7	0.0348	10
Osceola	96.40	21	98.45	25	0.0164	28
Palm Beach	105.87	4	103.61	2	-0.0181	64
Pasco	95.71	27	98.20	28	0.0199	24
Pinellas	101.46	6	100.24	10	-0.0098	61
Polk	95.35	30	98.85	22	0.0280	14
Putnam	92.96	55	96.24	37	0.0262	19
St. Johns	97.07	14	98.57	24	0.0120	39
St. Lucie	96.35	22	98.28	27	0.0154	33
Santa Rosa	93.13	52	95.79	43	0.0213	21
Sarasota	99.39	8	98.45	25	-0.0075	58
Seminole	96.59	16	100.01	12	0.0274	17
Sumter	93.18	50	95.14	49	0.0157	30
Suwannee	92.14	59	92.10	64	-0.0003	53
Taylor	94.53	36	95.87	42	0.0107	43
Union	91.95	61	95.92	41	0.0318	12
Volusia	96.60	15	96.16	39	-0.0035	56
Wakulla	94.71	33	99.48	14	0.0382	6
Walton	92.99	53	91.84	65	-0.0092	60
Washington	91.66	62	91.68	66	0.0002	51

If, in general, the highest cost areas tend to be high amenity areas, so that the FPLI_U over-compensates high cost areas, as we have hypothesized, then changing to the FPLI_AS should tend to reduce the DCD where the FPLI_U is large and increase it where the FPLI_U is small. Table 3.10 tabulates changes in the DCD by the level of

FPLI_U. The table shows that 55.3% of the state's population would have a higher DCD using FPLI_AS. Almost all of these, 53.63% of the state's population, had an FPLI_U less than 100. Similarly, while 44.7% of the state's population would have a lower DCD, Table 3.10 shows that most of these, 37.07% of the state's population, have an FPLI_U of over 100. This is strong evidence that the FPLI_U overcompensates for price differences, and that, therefore, FPLI_AS is a superior basis for the DCD.

Table 3.10: Effect of Amenity Adjustment and Smoothing

		Estimated Change in DCD			
		Negative		Positive	
		Number of Counties	Population Share	Number of Counties	Population Share
FPLI-U	Less Than 100	10	7.64%	51	53.63%
	Greater Than 100	5	37.07%	1	1.66%
TOTAL		15	44.70%	52	55.30%

Table 3.11 presents summary statistics for FPLI_U (three-year average for 2001, 2002, and 2003) and FPLI_AS. The minimum of FPLI_U is 91.08, and the maximum is 111.23. The minimum of FPLI_AS is 90.30, and the maximum is 104.47. Thus, the range of the three-year average of FPLI_U is 20.15, while the range of FPLI_AS is 14.17. The range, however, is not a very good measure of the spatial variation of the indexes since it depends only on the two most extreme values, which may be overly influenced by statistical noise, and which provides no information about the variation exhibited by most counties. A better measure is the population-weighted mean absolute deviation (PWMAD). That statistic is the average amount by which the measured cost of living deviated from the state average of 100. For the FPLI_U, PWMAD is 4.59, while it is only

2.12 for the FPLI_AS. Thus the smoothed, amenity-adjusted FPLI exhibits less than half the variation of the non-amenity-adjusted FPLI.

Table 3.11 Alternative FPLI
Summary Statistics

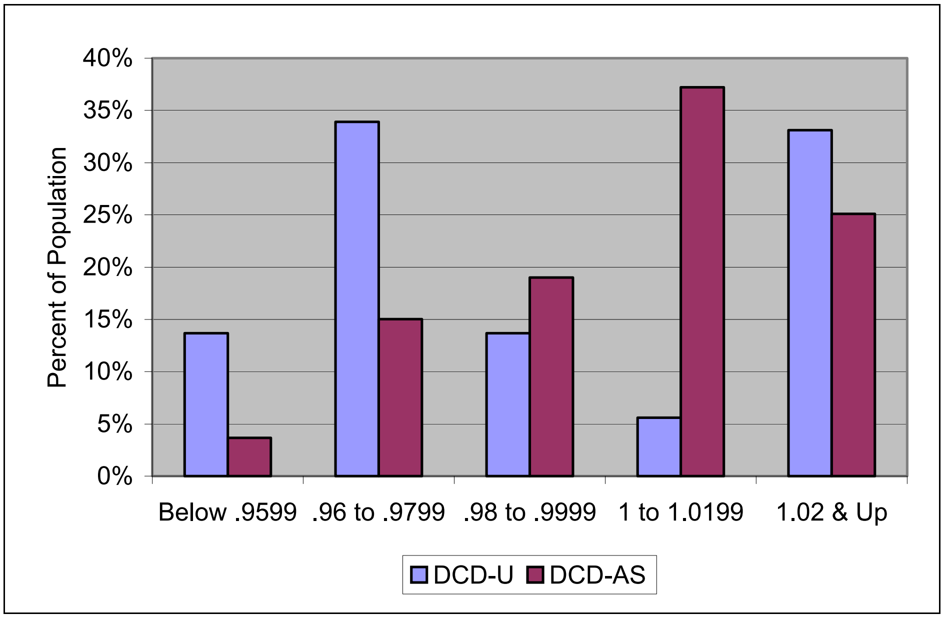
	FPLI-U	FPLI-AS
Minimum	91.08	90.3
Maximum	111.23	104.47
Range	20.15	14.17
PWMAD	4.59	2.12

Even more information may be gleaned from looking at the population distribution of the two versions of the DCD based on the two versions of the FPLI. Table 3.12 and Figure 3.3 present this information. While the DCD_U places most of the states population either several points above 1.00 or several points below 1.00, the DCD_AS places 56.21% of the state's population between 0.98 and 1.02. Thus, however measured, the variation of a DCD based on FPLI_AS across districts is far less than the variation of the current DCD based on FPLI_U.

Table 3.12: Alternative DCD
Population Distribution

Population Share	DCD-U	DCD-AS
Below 0.9599	13.68%	3.66%
0.960 to 0.9799	33.92%	15.01%
0.980 to .9999	13.67%	19.01%
1.000 to 1.0199	5.60%	37.20%
1.020 & Up	33.13%	25.11%

Figure 3.3 Alternative DCD Population Distributions



While DCD_AS exhibits considerably less variation across districts than DCD_U, it does represent significant funding changes relative to DCD_U. Summary statistics for the change in the DCD are presented in Table 3.13. The student-weighted mean absolute change is .0275, meaning that the typical student would find their base funding changed by 2.75%, up or down. The maximum increase is .0544 in Leon County, and the maximum decrease is -.0766 in Monroe County. From Table 3.9, we see that the largest increases in the DCD would occur in Leon, Duval, Gadsen, and Nassau counties. Similarly, the largest decreases would occur in Monroe, Miami-Dade, and Broward counties. Figures 3.4A and 3.4B plot changes in the DCD against UWFTE.

Table 3.13: DCD Change Summary Statistics

	Change in DCD
Largest Increase	0.0544
Largest Decrease	0.0766
SWMAD	0.0275

Note: SWMAD stands for Student Weighted Mean Absolute Deviation

Taken together, there is strong evidence that FPLI_AS is a better basis for the DCD than FPLI_U. While a decision to switch to FPLI_AS would have significant funding effects on several large districts, these changes would be in the direction of a more accurate reflection of the costs of providing a constant quality of education.

Figure 3.4A Effect of Amenity Adjustment and Smoothing, Large Districts

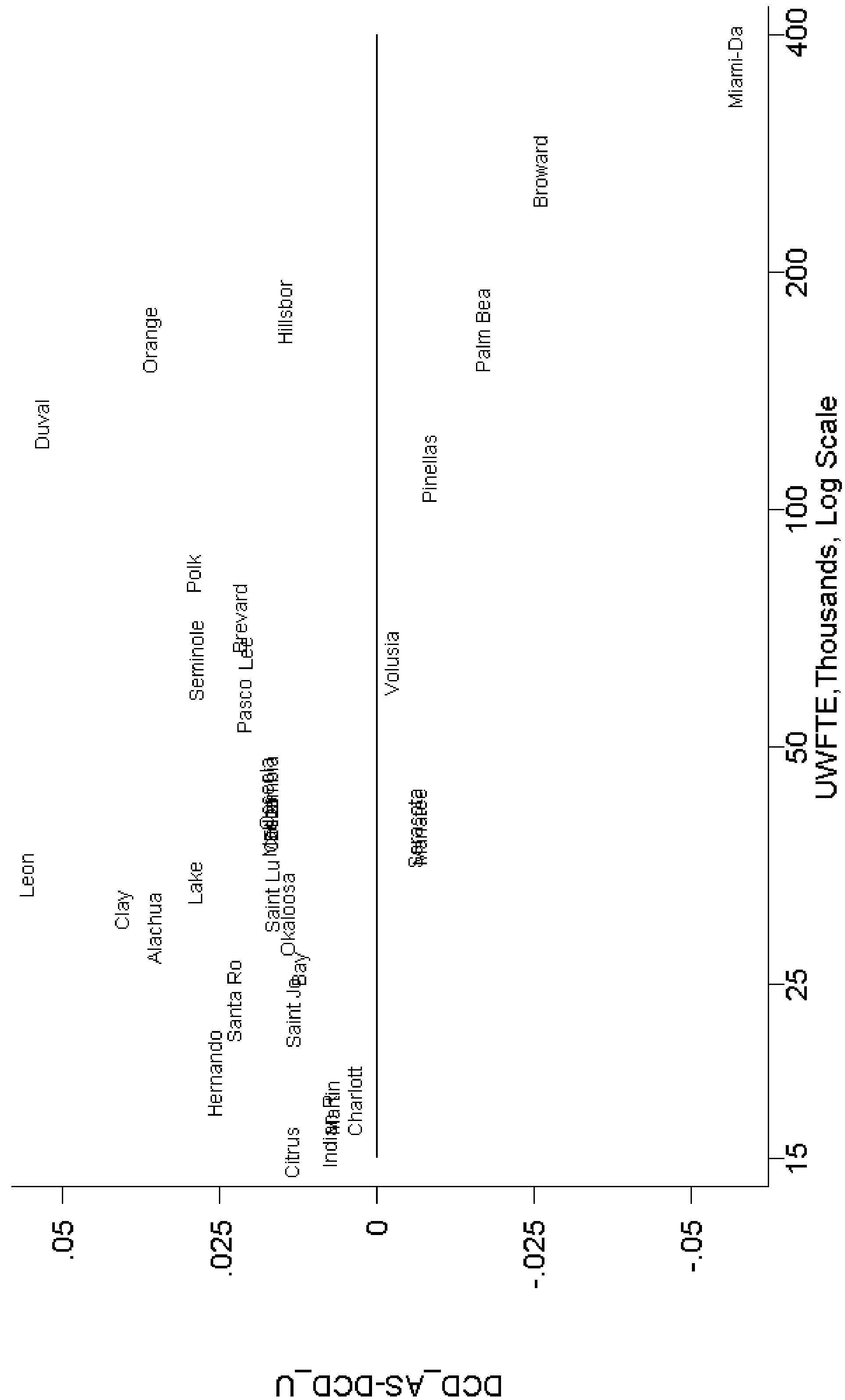
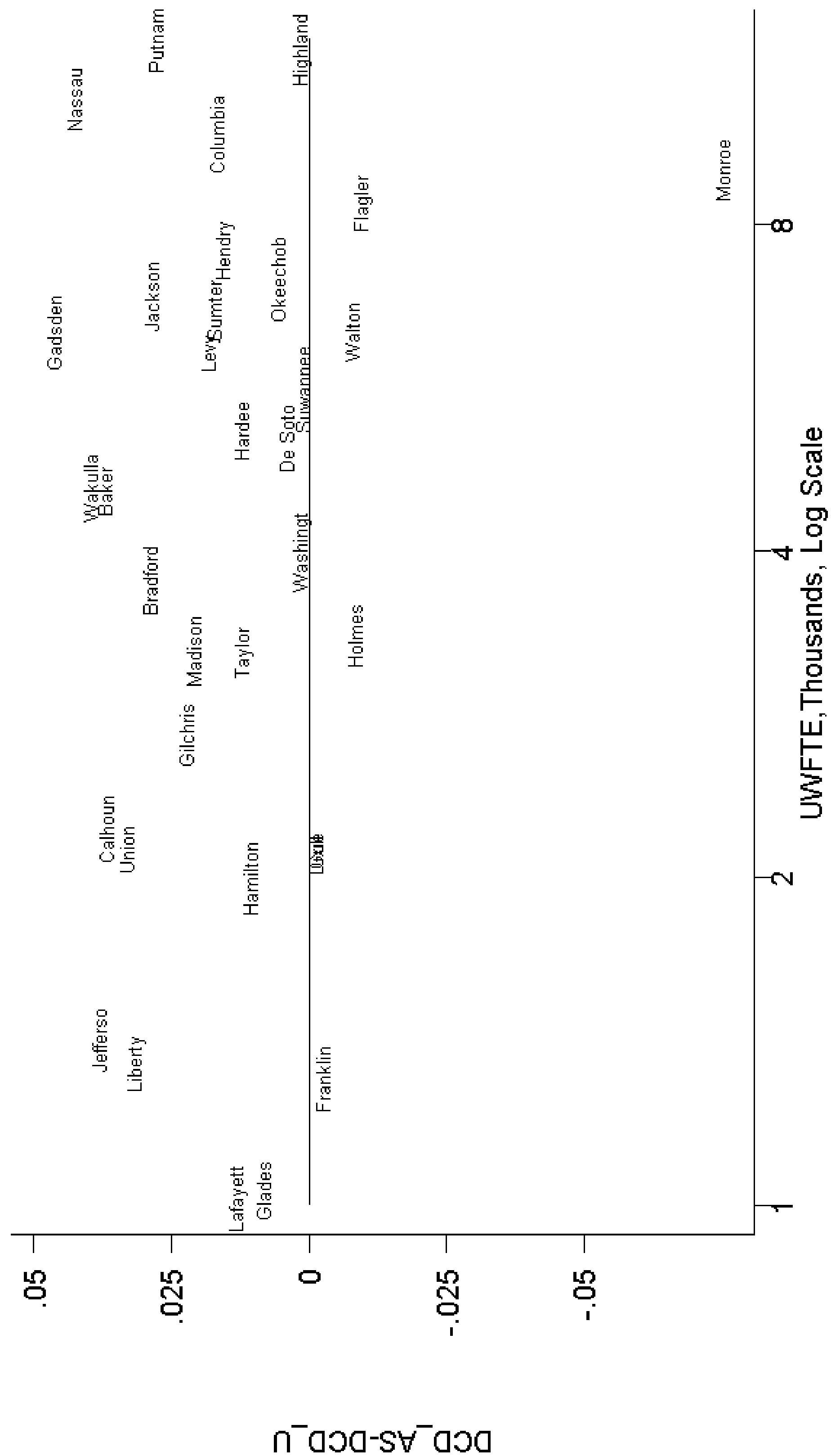


Figure 3.4B Effect of Amenity Adjustment and Smoothing, Small Districts



3.6 An Index Based on Actual Teacher Salaries

No index based on general wage and price data will match teachers' wages perfectly across Florida's school districts. Nor will any price index or any blended wage-price index. Those facts raise an obvious question: why not replace the FPLI component of the DCD with an index of the wages that the state's school districts actually pay? The most fundamental reason not to do so is that if the state distributes funds to local districts in direct proportion to what they pay, the districts will have an incentive to "game the system." Their incentive would be to pay teachers more so they receive more from the state, rather than to make optimal trade-offs among what to pay teachers, how many teachers to hire, and what to pay for other educational inputs. Over time the index so constructed would come to reflect cost conditions less and less and the willingness to game the system more and more. This effect could be attenuated through delay: funds could be distributed according to salaries paid several years ago. The longer the lag the weaker the incentive to push up wages artificially. Offsetting that, the longer the lag the weaker the presumed correlation between current conditions and the allocation of funds.

In our view, and the view of other school finance experts, these are compelling reasons not to use actual wage (McMahon, 1994). There is, however, one way to use an index based on actual teachers' compensation that would avoid the incentive to distort the index through the action of school boards. That way is to make it a one-off deal. An index based on actual teachers' pay would be constructed from, say, 2002-2003 or from an average of several years, and then used for next five years, say, with the explicit understanding that after that there would be a return to a use of some other method and that no index based on actual pay would be used again. We do not think such a method is likely to be adopted. For one thing, it would introduce two strange fluctuations into the DCD, though presumably they could be smoothed.

Because of legislative interest, however, we consider an index based on actual teachers' pay. Aside from incentives to game the system, there are two major reasons to think such an index would inaccurately reflect costs. The first is that pay may be higher in some districts because of stronger teachers' unions or perhaps greater teacher control of school boards. The legislature may think it inappropriate to require taxpayers in other districts to pay for that union strength. The second is that, after controlling for the price level and amenities, paying more should help a district recruit better teachers. To illustrate this point, consider variations in teachers' pay across five coastal districts in the panhandle, shown in the Table 3.14.

Table 3.14 Teacher Pay and Other Characteristics, Panhandle Districts

District	Average Pay	FPLI	Free Lunch	DEGEXP	Backload
Escambia	$34,821	0.936	65.6%	0.962	1.75
Santa Rosa	$37,947	0.931	39.6%	1.024	1.92
Okaloosa	$41,815	0.937	38.6%	1.046	2.01
Walton	$35,804	0.937	58.3%	0.986	1.89
Bay	$37,383	0.938	56.2%	1.040	1.81

Okaloosa stands out. Okaloosa teachers are paid 10% more than those in Santa Rosa, 12% more than in Bay, 17% more than in Walton, and 20% more than in Escambia. Not surprisingly, since these are geographically similar counties, the price level as measured by the FPLI is virtually identically across the five counties. Moreover, Okaloosa does not have to compensate teachers for the relatively low socio-economic status of its students. Its share of primary students eligible for free or reduced lunch (Free Lunch) is the lowest of the five counties and well below the 52% average for Florida.

If Okaloosa is unable, with its premium pay, to obtain better teachers than the other four districts listed, one would have to wonder what is happening there. In the second to last column, we present crude evidence that they do manage to hire better teachers. DEGEXP is a measure of teacher quality based only on degrees and experience, which we will describe more fully later. Based on that measure, Okaloosa has the best teachers of the five districts, though the difference is not enough to account for the full pay premium. The last column of the table above, Backload, suggests a possible explanation. Backloading, the degree to which senior teachers are paid more than those less senior, is often used in the educational finance literature to measure union strength in school districts. Okaloosa has the most backloading of any of the five districts, and indeed backloads its pay more than any other district in Florida. We have not studied this issue closely enough to claim that Oskaloosa's extreme backloading does in fact reflect union strength, present or past, or, more generally, strong teacher influence on the school board. We simply note that such influence would be a standard interpretation.

A counter-argument to the effect of union strength or teachers' control of school boards is that the state's goal is to provide a high-quality education to every child, and if the child happens to live in a district that must pay more because of a strong union or controlled board, then so be it. The state simply has to accommodate that strength or control as part of paying for the quality of education the child deserves.

Though looking at replacing the FPLI component of the DCD with an index of what teachers are actually paid was not explicitly part of our charge in this project, there has been an expression of interest in its use. For that reason, we look at it briefly. A full analysis of the effect of using a direct measure of wages actually paid school district personnel in the DCD would require estimating the time path of districts' responses to the incentives doing so would set up. Essentially, it would require trying to guess which districts would raise teachers' pay more rapidly and by how much in order to gain more state funds. Rather than do that, for now we limit our presentation to estimate how replacing the FPLI in the DCD with an index of teachers' actual salaries would redistribute funds in the first year. A quick comparison of results follows:

(1) In 2001, using the FPLI in the DCD redistributed funds from other districts to seven districts containing 41% of the state's population. Ranked by order of gain per FTE, the benefiting districts were: Monroe, Miami-Dade, Palm Beach, Broward, Pinellas, Collier, and Sarasota.

(2) Using a simple index of what teachers are actually paid would redistribute 59% *more* money than using the FPLI, which would go to eight districts containing 41% of the state's population. Ranked by order of gain per FTE, these eight counties are: Palm Beach, Miami-Dade, Collier, Sarasota, Broward, Okaloosa, Duval, and Monroe.

(3) Using an index of what teachers are actually paid, but adjusted for teachers' degrees and experience, would redistribute 72% *more* than using the FPLI. The money would go to seven districts containing 37% of the state's population. Ranked by order of gain per FTE: Miami-Dade, Collier, Palm Beach, Broward, Sarasota, Hendry, and Monroe.

In summary, using either the pure actual pay index or the adjusted actual pay index would give roughly the current beneficiaries substantially more money. Miami-Dade, Broward, Palm Beach, Collier and Sarasota would be consistent winners from replacing the FPLI with an actual pay index. Okaloosa and Duval would move into the recipient column from using the unadjusted version. Using the adjusted version would make Hendry a recipient.

We begin by comparing the FPLI and an index of what teachers are actually paid, their average salaries. Table 3.15 shows (1) an index of teachers' average pay, with the Florida average set to one; (2) the 2001 FPLI; and (3) the difference between the two, with districts ranked from largest to smallest difference. Districts gaining the most in total (not per FTE) from using an average salary index instead of the FPLI are Miami-Dade, Palm Beach, and Duval. Districts losing the most in total dollars are Hillsborough, Orange, Pinellas, and Polk.

Table 3.15 The FPLI and an Average Wage Index

District	Actual Salary Index	FPLI 2001	Difference	Accumulated Population (%)
Okaloosa	1.034	0.9373	0.097	1.07
Collier	1.107	1.0143	0.093	2.64
Suwannee	0.985	0.9174	0.067	2.86
Sarasota	1.060	1.0010	0.059	4.90
Palm Beach	1.123	1.0699	0.054	11.97
Miami-Dade	1.122	1.0710	0.051	26.07
Duval	1.013	0.9688	0.044	30.95
Nassau	0.969	0.9366	0.032	31.31
Washington	0.947	0.9213	0.026	31.44
Charlotte	0.976	0.9537	0.022	32.33
Sumter	0.945	0.9242	0.021	32.66
Lee	0.994	0.9797	0.015	35.42
Santa Rosa	0.938	0.9308	0.007	36.15
Martin	0.972	0.9706	0.001	36.95
Broward	1.059	1.0575	0.001	47.10
Highlands	0.932	0.9369	-0.005	47.65
Volusia	0.950	0.9562	-0.006	50.42
Okeechobee	0.947	0.9566	-0.009	50.65
Marion	0.928	0.9375	-0.009	52.27
Brevard	0.955	0.9641	-0.010	55.25
Pasco	0.941	0.9506	-0.010	57.40
St. Lucie	0.951	0.9606	-0.010	58.61
Leon	0.957	0.9700	-0.013	60.11
Manatee	0.971	0.9849	-0.014	61.76
Putnam	0.925	0.9392	-0.014	62.20
Bay	0.924	0.9385	-0.014	63.13
Indian River	0.946	0.9609	-0.015	63.84
Seminole	0.943	0.9587	-0.016	66.12
Levy	0.910	0.9277	-0.018	66.34
Columbia	0.904	0.9229	-0.019	66.69
Taylor	0.933	0.9521	-0.019	66.81
Clay	0.930	0.9526	-0.023	67.69
Pinellas	0.996	1.0194	-0.023	73.46
Lake	0.931	0.9557	-0.025	74.77

Continued . . .

Table 3.15 The FPLI and an Average Wage Index (Continued)

District	Actual Salary Index	FPLI 2001	Difference	Accumulated Population (%)
Gulf	0.910	0.9373	-0.027	74.86
Hardee	0.909	0.9383	-0.029	75.03
Holmes	0.886	0.9236	-0.037	75.14
Flagler	0.929	0.9665	-0.037	75.45
Bradford	0.898	0.9354	-0.037	75.62
Hillsborough	0.959	0.9986	-0.040	81.87
Hendry	0.933	0.9744	-0.041	82.09
Orange	0.935	0.9767	-0.042	87.70
St. Johns	0.929	0.9721	-0.043	88.47
De Soto	0.904	0.9484	-0.044	88.67
Hamilton	0.862	0.9083	-0.046	88.76
Citrus	0.875	0.9215	-0.047	89.50
Polk	0.904	0.9544	-0.050	92.52
Gilchrist	0.873	0.9248	-0.052	92.61
Walton	0.885	0.9368	-0.052	92.87
Glades	0.911	0.9673	-0.056	92.93
Jackson	0.845	0.9023	-0.057	93.23
Baker	0.873	0.9305	-0.057	93.37
Osceola	0.904	0.9636	-0.060	94.45
Hernando	0.864	0.9253	-0.061	95.26
Calhoun	0.853	0.9224	-0.069	95.35
Escambia	0.861	0.9357	-0.075	97.19
Wakulla	0.877	0.9547	-0.078	97.33
Franklin	0.873	0.9610	-0.088	97.40
Alachua	0.859	0.9529	-0.094	98.76
Madison	0.849	0.9450	-0.096	98.88
Jefferson	0.857	0.9530	-0.096	98.96
Lafayette	0.808	0.9115	-0.103	99.01
Monroe	1.001	1.1051	-0.104	99.50
Liberty	0.824	0.9345	-0.111	99.55
Gadsden	0.812	0.9440	-0.132	99.83
Dixie	0.783	0.9268	-0.144	99.92
Union	0.756	0.9136	-0.158	100.00

Next, we adjust for the fact that Florida's school districts pay teachers more if they have greater educational attainment or if they have more years of experience. One district may pay more than another simply because it hires teachers with more credentials or with more years of teaching. To account for this we construct the variable DEGEX, an index that weights teachers' degrees and experience by the average increase in pay they receive for the extra degrees and experience. We begin by calculating the average minimum pay across districts by highest degree obtained and, for each degree, the average increase from the minimum for each extra year of experience. In Florida, the average minimum pay, weighting districts by the number of teachers in each category, is $30,180 for teachers whose highest degree is a bachelor's, and so on. For teachers with a bachelor's only, the average gain in pay from an extra year of experience is $675. Relevant data for Florida are presented in Table 3.16.

Table 3.16 Florida K-12 Public School Teachers

Degree	Average Minimum Pay	Average Gain from Extra Year	Share of All Teachers	Average Experience
Bachelor's	$30,180	$675	60.50%	10.89
Master's	$32,577	$731	35.53%	15.93
Specialist	$35,681	$853	2.79%	18.47
Doctorate	$36,509	$852	1.18%	16.65

Source: Florida Department of Education, Bureau of Education Information & Accountability Services, *Statistical Brief: Teacher Salary, Experience, and Degree Level 2002-03*, Series 2003-23B, May 2003.

With these data, $CDEX_{FL}$, the composite degree-experience compensation for Florida is constructed as:

$$CDEX_{FL} = 0.6050*(30180 + 675*10.89)$$
$$0.3553*(32577 + 731*15.93)$$
$$0.0279*(35681 + 853*18.47)$$
$$0.0118*(36509 + 852*16.65) = \$40,451.$$

For the Miami-Dade district the relevant data are:

Table 3.17 K-12 Public School Teachers: Miami-Dade

Degree	Share of All Teachers	Average Experience
Bachelor's	48.04%	6.77
Master's	39.60%	12.60
Specialist	9.92%	18.11
Doctorate	2.44%	15.66

These figures, employing the statewide average minimum pay by degree and the average statewide gain in pay from an extra year, yield Miami-Dade's CDEX

$$CDEX_{Miami\text{-}Dade} = 0.4804*(30180 + 675*6.77)$$
$$0.3960*(32577 + 731*12.60)$$
$$0.0992*(35681 + 853*18.11)$$
$$0.0244*(36509 + 852*15.66) = \$39,529$$

This is two percent lower than $CDEX_{FL}$ because the greater educational attainment of Miami-Dade's teachers – they are over three times as likely as those in the rest of the state to have a specialist degree or a doctorate – is a bit more than offset by their averaging only 10.40 years of experience, instead of 12.96. The actual average salary in Miami was $45,379, or 14.6% higher than its CDEX, the degree-experience composition of its teaching pool, would suggest, because of the area's relatively high cost of living, its large proportion of foreign-language students, among other reasons.

We then divide each county's CDEX by $CDEX_{FL}$ to create DEGEX. For Miami-Dade, this yields:

$$DEGEX_{Miami\text{-}Dade} = (\$39{,}529)/(\$40{,}451) = 0.977.$$

We now normalize the DEGEX to one, weighting by the number of students in each district, to construct ATPINDEX, or the adjusted teachers pay index. Table 3.18 displays ATPINDEX by district, as well as the FPLI, the difference between ATPINDEX and the FPLI, and the accumulated population of counties favored by ATPINDEX over the FPLI. That is, Table 3.18 modifies Table 3.15 to adjust for differences across districts in average degrees and experience of teachers. The results are similar to those of Table 3.15. In total dollars, the largest winner is Miami-Dade by far.

For context, we recall the columns of Table 3.15. Average Salary Index is an index of the average salary normalized so that the teacher-weighted average for Florida is one, for the 2002-03 school year. The FPLI is the Florida Price Level Index for 2001. The column Difference is ATPINDEX minus the FPLI, expressed as a percentage. Accumulated Population is the percentage of the state's population in either the county named on that row or counties that gain more per student.

To continue our illustration with Florida's largest district: from Table 3.15 Miami-Dade's Average Salary Index is 1.122, its FPLI is 1.071, and the difference between the two is 5.10 percentage points. Miami-Dade and districts gaining more per FTE contain 26.07% of the states population.

Turning to Table 3.18, recall that DEGEX is an index of composite degree attainment and experience of teachers, described in the text. Then Miami-Dade's DEGEX is 0.977, its experience-degree adjusted teacher pay is 14.6% above the state average, its FPLI is

7.1% higher than the state average, and the difference between the ATPINDEX and the FPLI is 7.5 percentage points. Miami-Dade and Collier together contain 15.7% of the state's population.

Table 3.18 Effect of an Average Actual Teacher Pay Index Adjusted for Degrees and Experience

District	DEGEX	ATPINDEX	FPLI 2001	Difference	Accumulated Population (%)
Collier	0.995	1.111	1.014	0.97	1.60
Miami-Dade	0.977	1.146	1.071	0.75	15.7
Nassau	0.971	0.996	0.937	0.60	16.0
Suwannee	1.015	0.969	0.917	0.51	16.3
Hendry	0.911	1.023	0.974	0.48	16.5
Okaloosa	1.049	0.984	0.937	0.47	17.5
Sarasota	1.020	1.038	1.001	0.37	19.6
Palm Beach	1.025	1.095	1.070	0.25	26.7
Duval	1.020	0.992	0.969	0.23	31.5
Broward	0.982	1.077	1.058	0.19	41.7
Pasco	0.971	0.967	0.951	0.16	43.8
Martin	0.987	0.983	0.971	0.13	44.6
Charlotte	1.021	0.954	0.954	0.00	45.5
Lee	1.015	0.978	0.980	-0.02	48.3
St. Lucie	0.991	0.958	0.961	-0.03	49.5
Brevard	0.996	0.957	0.964	-0.07	52.5
Lake	0.982	0.947	0.956	-0.09	53.8
Manatee	0.995	0.974	0.985	-0.11	55.4
Taylor	0.990	0.940	0.952	-0.12	55.6
Volusia	1.006	0.943	0.956	-0.13	58.3
Osceola	0.952	0.948	0.964	-0.15	59.4
Washington	1.045	0.905	0.921	-0.16	59.5
Santa Rosa	1.024	0.914	0.931	-0.16	60.3
Sumter	1.040	0.907	0.924	-0.17	60.6
Glades	0.958	0.950	0.967	-0.18	60.7
Indian River	1.003	0.942	0.961	-0.19	61.4
Clay	0.995	0.933	0.953	-0.19	62.3
Marion	1.013	0.915	0.938	-0.22	63.9
Flagler	0.986	0.941	0.966	-0.26	64.2
Hardee	0.996	0.911	0.938	-0.27	64.4
Orange	0.983	0.949	0.977	-0.28	70.0
Hillsborough	0.987	0.970	0.999	-0.28	76.2
Okeechobee	1.020	0.927	0.957	-0.29	76.5
Putnam	1.017	0.908	0.939	-0.31	76.9

Continued…

Table 3.18. Effect of an Average Actual Teacher Pay Index Adjusted for Degrees and Experience (Continued)

District	DEGEX	ATPINDEX	FPLI 2001	Difference	Accumulated Population (%)
Holmes	0.993	0.892	0.924	-0.32	77.0
Calhoun	0.962	0.886	0.922	-0.37	77.1
De Soto	0.994	0.909	0.948	-0.40	77.3
Walton	0.986	0.897	0.937	-0.40	77.5
Highlands	1.038	0.896	0.937	-0.41	78.1
St. Johns	1.000	0.927	0.972	-0.45	78.9
Columbia	1.028	0.878	0.923	-0.45	79.2
Escambia	0.966	0.890	0.936	-0.46	81.1
Pinellas	1.022	0.973	1.019	-0.46	86.8
Hamilton	0.999	0.861	0.908	-0.47	86.9
Bay	1.040	0.888	0.938	-0.51	87.8
Levy	1.037	0.876	0.928	-0.51	88.1
Polk	1.001	0.902	0.954	-0.52	91.1
Bradford	1.017	0.882	0.935	-0.54	91.2
Hernando	0.993	0.870	0.925	-0.56	92.1
Seminole	1.044	0.902	0.959	-0.57	94.3
Leon	1.058	0.903	0.970	-0.67	95.8
Citrus	1.026	0.851	0.922	-0.70	96.6
Gilchrist	1.022	0.854	0.925	-0.71	96.7
Gulf	1.053	0.864	0.937	-0.74	96.8
Baker	1.041	0.838	0.930	-0.93	96.9
Lafayette	0.987	0.818	0.911	-0.94	96.9
Liberty	0.981	0.839	0.934	-0.96	97.0
Wakulla	1.021	0.858	0.955	-0.97	97.1
Monroe	0.995	1.004	1.105	-1.01	97.6
Franklin	1.023	0.852	0.961	-1.09	97.7
Jackson	1.071	0.788	0.902	-1.14	98.0
Dixie	0.980	0.798	0.927	-1.29	98.1
Union	0.967	0.780	0.914	-1.33	98.2
Jefferson	1.051	0.813	0.953	-1.40	98.2
Alachua	1.057	0.812	0.953	-1.41	99.6
Madison	1.080	0.785	0.945	-1.60	99.7
Gadsden	1.046	0.775	0.944	-1.69	100.0

4. Review of the Sparsity Supplement

4.1 Introduction

Do large schools (districts) do a better job of teaching than do small schools (districts)? This is a question with important consequences for policy-makers, taxpayers, parents, and teachers alike – to be sure – and a seemingly straight-forward one. But before attempting to analyze any aspect of it, one must first decide precisely how to approach the issue, and two main courses have been taken in the scholarly literatures.

Researchers in the field of education appear to generally phrase the issue thusly: Are the results of the schooling process, i.e. outcomes, better in larger schools (districts) or smaller ones? The usual finding (subject to some qualifications) is that smaller is better. Lee and Smith (1997) find that schools of between 600 and 1,200 students generate the best outcomes, depending on which specific outcomes are desired. In particular, they were interested in schools' average improvement in math and reading scores and in the "equity" in the distribution of such improvements among racial and socio-economic groups, but they did not present formal regression results, instead relying on graphical representations of their findings. Their study also provides a brief but effective review of the then-current education literature on the subject.[8]

Economists, on the other hand, generally phrase the question as follows: Holding the quality of education and all other things unchanged, will a school (or district) with more students have lower per-pupil costs than one with fewer students? An affirmative answer to this question suggests the presence of what economists call *economies of scale*, meaning that per-pupil costs of providing a given quality education fall as enrollment increases. Similarly, if the per-pupil costs of providing a given quality of education rise

[8] This was the most recent of the few studies we could find in the education literature on the effects of size.

as enrollment rises, this is evidence of *diseconomies of scale*. Taken together, economies and diseconomies of scale are known as scale impacts.

4.2 Recent Economic Literature on Scale Impacts in Education

The economics literature to date, spanning nearly forty years of research, can point to no consensus as to the existence of scale effects in education. Kenny (1982), however, testifies that much of the literature to the late 1970s had found evidence of economies of scale, and these results were often used in support of the movement to consolidate schools and school districts. While the issue of consolidation is not the focus of this report, Kenny (1982, p. 2) notes that findings and estimates of economies of scale "are nevertheless useful, for [they] may be used to ascertain how much more expensive schooling is in rural areas than in urban areas."

Dewey, Husted, and Kenny (2000), DHK, conduct a reanalysis of 127 regressions in 46 individual studies, containing a total of 83 regressions testing for scale effects (these are here called "scale-regressions"). Note that the presence of scale effects—namely economies of scale—was only one of the hypotheses their review considered. DHK were interested in drawing attention to a problem arising from a misspecification frequent in the literature.[9] They thus partitioned all of the regressions into "good" and "bad" categories, which avoided and suffered from this problem, respectively. The results of their meta-reanalysis, with respect to scale effects, are reproduced in Table 4.1, where

[9] The hypothesized misspecification is the inclusion of a term measuring parental income in the estimation of the education production functions. Parental income is not, per se, an *input* in a child's education, so this is a potentially serious problem, since production functions measure the technical relationships between *inputs* and *output*. The inclusion of parental income could thus introduce bias against actual educational inputs, such as teachers per pupil, teachers' salary, or parents' time spent helping their children study. DHK find in their own analyses that such a misspecification indeed prejudices results against other inputs.

positive (negative) coefficients suggest economies (diseconomies) of scale, and in which "significant" coefficients indicate strong evidence of scale effects.[10]

Table 4.1 Summary Results for Scale Impacts, by Characteristic of Coefficient and by Category of Study

	Studies		
Coefficient	All	Good	Bad
Positive	46%	71%	37%
Negative	54%	29%	63%
Positive and Significant	18%	38%	11%
Negative and Significant	30%	10%	37%
Total	83	21	62

Source: Dewey, Husted, and Kenny (2000), Tables 1-3

Overall, the picture their results paint is muddy, since nearly half of the 83 scale-regressions have positive coefficients for scale terms, while those in the other regressions are negative. Of all the scale-regressions, 30% are significantly negative, while 18% are significantly positive. Their good studies are the most supportive of economies of scale: 71% of the good studies indicate economies of scale. This support is weak, nonetheless, as only 38% of the good studies are both positive and statistically significant.

A review of 22 articles examining scale impacts by Andrews, Duncombe and Yinger (2002), ADY, comes to roughly the same conclusion. No consensus exists in the literature at large. They note (p. 246) the following when the literature finds indications of economies of scale:

> Cost function results indicate potentially sizeable [economies of scale for districts of] enrollment levels between 2,000 and 4,000 students… At the school level, production function studies provide some evidence that moderately sized elementary schools (300-500 students) and high schools

[10] Where "significance" or "significant" implies a 95% or greater level of confidence in the coefficient's being non-zero.

(600-900 students) may optimally balance economies of size with the negative effects of large schools.[11]

Such negative effects might include “lower student and staff motivation and [less] parental involvement” (p. 246, emphasis deleted). These negative effects, as the literature frequently acknowledges, are difficult to quantify in their own rights, even in the settings of student-level survey data. These effects are particularly difficult to quantify with respect to school districts, which are the predominant units of observation in the economics literature. Frequently, more readily available data are used as proxies, an approach similar to that which generated the parental-income misspecification noted earlier. ADY note an additional disadvantage of larger schools, particularly in rural and sparsely populated areas, could be that more time and money might have to be spent by parents, students, and schools or districts in terms of taking students to and from school.[12]

Most recently, Dodson and Garrett (2002) analyze per-pupil variable costs of 287 school districts in Arkansas during the 1999-2000 school year, comprising teacher salaries, supplies, and transportation, as well as the sum of these categories, total variable costs. Their analysis is of particular relevance for Florida’s sparsity index because (1) it is well-conceived, (2) Alabama has a large number of small districts, and (3) Alabama provides a large amount of cost information over the small scale to which Florida’s sparsity compensation applies. To measure scale impacts, they include district enrollment as an explanatory variable; to control for the quality of education, both district drop-out rates and average scores from the American College Test (ACT) are employed, as are

[11] In the same passage they note findings “that sizeable diseconomies of [scale] may begin to emerge for districts above 15,000 students,” suggesting that the maximum efficient scale for school districts may be in a neighborhood around 15,000 students.
[12] Kenny (1982) was the first to bring attention to such costs arising from the consolidation of schools themselves, as opposed to the consolidation only of districts’ administrations.

various measures of student characteristics and family background. They also use a median-voter education demand model based on that of Downes and Pogue (1994) to estimate the effects of the community's demand for education.

Their analysis finds that statistically significant economies of scale are exhausted for total, teacher-salary, and supply costs at district enrollment levels of 3,500, 1,850, and 525 students, respectively.[13] Economies of scale in district transportation costs appear to be exhausted between enrollment levels of 500 and 1,000 students.[14] This means that in order to produce an education of a given quality, school districts in Arkansas with enrollments of roughly 3,500 students appear to operate with lower per-pupil total costs than smaller school districts. Their findings, as well as the total-cost-minimizing enrollment of 15,900 required by the assumed functional form of their cost function, accord quite well with those summarized by ADY.

4.3 Analysis of Florida's Sparsity Program

4.3.1 Current supplement formula.

Despite the lack of agreement among economists on the existence, nature, and magnitude of scale impacts in education, the State of Florida, in the FEFP, currently presumes – and has presumed since 1975 – that smaller school districts do in fact incur higher per-pupil costs in order to provide a given level of education, and this presumption

[13] We should note that the assumed functional form of the cost function, when combined with their regression results, predicts that district per-student total variable costs are minimized at an enrollment of roughly 15,900 students. The maximum district enrollment in their sample is 9,002 students, so costs necessarily decrease over the whole domain of enrollments. Beyond the thresholds stated above, however, such decreases in costs cease to be statistically significant.

[14] They note that "the large variation in transportation costs across districts makes any decrease in costs per-student at low enrollment levels…statistically insignificant" and obtain this range by visual inspection of their results.

is embodied in the state's *sparsity supplement*, for which the calculation is as follows.[15] First determined for each district is the *district sparsity index*, which is a district's full-time equivalent students in all programs divided by that district's number of permanent senior high school centers, not in excess of three. This index is then used in the following equation to construct the *sparsity factor*:[16]

$$\text{Sparsity factor } = \frac{1101.8918}{2700 + \text{sparsity index}} - 0.1101 \qquad (4.1)$$

To produce the initial computed sparsity supplement, this factor is then multiplied by both the district's number of weighted full-time equivalent students and the State's base per-student funding (where each of these two is computed separately). Then *wealth adjustments* are deducted from this figure to produce the wealth-adjusted sparsity supplement, which may not be less than \$0. Furthermore, the Florida Department of Education is required to prorate this wealth-adjusted supplement according to the funds appropriated by the Legislature for the sparsity supplement in the annual general appropriations act. [17] The appropriation for sparsity in fiscal year 2003-2004 was exactly \$31 million, a figure unchanged since at least fiscal year 1997-1998. At the time of this report's writing, however, Governor Bush's proposed budget for 2004-2005 would increase the supplement by 2.1% to about \$31.65 million.[18] Table 4.2 presents relevant information for the 36 Florida school districts eligible in the fiscal year ending June 30, 2003 to receive sparsity funds before wealth adjustment, excluding special units such as laboratory schools and the Florida Virtual School.

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[15] The FEFP spans Part II of Chapter 1011, 2003 Florida Statutes (F.S.). The sparsity supplement's construction is detailed in section 1011.62 (6), on which the following discussion is based.
[16] This equation was estimated in 1975 with data for the 1974-1975 school year, using the method of least squares and has been unchanged since.
[17] See 2003 F.S. 1011.62 (9)(a) for the prorating procedure.
[18] Florida's e-Budget 2004-2005. Retrieve data from http://www.ebudget.state.fl.us/ (accessed February 2, 2004).

The sparsity calculation is based on an investigation of extra costs due to sparsity conducted for the Florida Department of Education by Johns, Morphet, and Adams (1975). While that report was consistent with the best evidence at that time, there has been a considerable amount of high quality work since then. Also, we know of no academic work on the soundness of the wealth adjustment. Accordingly, we now turn to consider needed changes to the sparsity supplement.

Table 4.2: Enrollment and Sparsity Supplements

County	FTE	As Calculated: Unadjusted Supplement	As Calculated: Wealth Adjustment	Prorated to $31 Million: Unadjusted Supplement	Prorated to $31 Million: Wealth Adjusted Supplement	Difference between Prorated Figures
Glades	1,022	$693,030	-$29,648	$379,704	$414,824	$35,120
Lafayette	1,029	$713,200	$0	$390,755	$445,976	$55,221
Franklin	1,310	$925,027	-$341,933	$506,813	$364,619	-$142,194
Liberty	1,346	$920,716	$0	$504,451	$575,740	$71,289
Jefferson	1,516	$847,824	$0	$464,514	$530,159	$65,645
Hamilton	2,032	$960,146	$0	$526,054	$600,396	$74,342
Gulf	2,121	$1,448,735	-$165,410	$793,748	$802,486	$8,738
Union	2,139	$948,927	$0	$519,908	$593,381	$73,473
Dixie	2,160	$979,221	$0	$536,505	$612,324	$75,819
Calhoun	2,173	$1,467,002	$0	$803,756	$917,342	$113,586
Gilchrist	2,621	$1,683,834	$0	$922,556	$1,052,931	$130,375
Taylor	3,294	$912,663	$0	$500,039	$570,704	$70,665
Madison	3,299	$904,279	$0	$495,445	$565,462	$70,017
Washington	3,388	$1,765,121	$0	$967,092	$1,103,761	$136,669
Holmes	3,401	$2,242,866	$0	$1,228,844	$1,402,504	$173,660
Bradford	3,894	$840,903	$0	$460,722	$525,831	$65,109
Baker	4,441	$725,511	$0	$397,500	$453,675	$56,175
Wakulla	4,540	$721,934	$0	$395,540	$451,438	$55,898
DeSoto	5,022	$616,861	$0	$337,972	$385,734	$47,762
Hardee	5,029	$613,532	$0	$336,148	$383,652	$47,504
Suwannee	5,607	$1,897,632	$0	$1,039,694	$1,186,623	$146,929
Levy	6,016	$2,872,524	$0	$1,573,827	$1,796,240	$222,413
Walton	6,160	$2,759,642	-$1,564,587	$1,511,980	$747,289	-$764,691
Sumter	6,327	$1,872,478	$0	$1,025,912	$1,170,893	$144,981
Gadsden	6,584	$2,907,152	$0	$1,592,800	$1,817,893	$225,093
Okeechobee	6,916	$119,026	$0	$65,213	$74,429	$9,216
Jackson	6,923	$3,013,411	$0	$1,651,018	$1,884,339	$233,321
Hendry	7,618	$1,701,815	$0	$932,408	$1,064,175	$131,767
Monroe	9,074	$2,871,968	-$4,582,562	$1,573,523	$0	-$1,573,523
Columbia	9,564	$1,351,328	$0	$740,379	$845,009	$104,630
Nassau	10,365	$2,683,734	-$186,573	$1,470,391	$1,561,519	$91,128
Highlands	11,334	$2,617,783	$0	$1,434,257	$1,636,946	$202,689
Putnam	12,043	$2,519,241	$0	$1,380,267	$1,575,326	$195,059
Citrus	15,096	$1,872,490	-$286,825	$1,025,919	$991,544	-$34,375
Charlotte	17,385	$1,285,783	-$1,599,409	$704,468	$0	-$704,468
Hernando	18,090	$1,097,303	$0	$601,201	$686,163	$84,962
Total	210,880	$54,374,642	-$8,756,947	$29,791,327	$29,791,327	$0
Mean	5,858	$1,510,407	-$243,249	$827,537	$827,537	$0

Source: *Florida Educational Finance Program: Final Calculation*, Florida Department of Education, Office of Funding and Finance Reporting, Fiscal Year 2002-2003. Note that this table excludes the Florida Virtual School and the three laboratory schools eligible for sparsity supplements; hence the total prorated, wealth-adjusted supplement provided here does not sum $31 million appropriated by the Legislature.

4.3.2 Wealth adjustment.

Two sparsely populated districts, Monroe and Charlotte, each had their entire sparsity supplement offset due to the wealth-adjustment. If there is merit to the notion that there should be some local discretionary funding based on a district's tax base, and if there is also merit to the notion that a sparsity supplement is needed, then offsetting the sparsity supplement by potential discretionary millage above the state average is contradictory. This is so because it runs counter to the sparsely populated district's ability to raise discretionary funding beyond the equal base provided for by the FEFP. If, on the other hand, such discretionary local funding is not appropriate, it should be abolished or wealth adjusted for all districts, not just those that are sparsely populated. If the sparsity supplement is retained, be it updated or unchanged, a swift end to the wealth adjustment would make the FEFP more transparent and more internally consistent. (Part 3 of this study considers the appropriate form of discretionary millage.)

4.3.3 A revised sparsity supplement.

In this section, we adopt Dodson and Garrett's (2002) regression equations and use them to predict per-pupil costs in Florida's districts to determine if, where, and under what possible modifications continuation of the sparsity supplement is advisable. We adopt two approaches to this. First, we allow only terms employing enrollment to vary and evaluate all other variables at the mean for the 67 districts.[19] Second, we use their enrollment coefficients to develop an index that could appropriately be multiplied by base funding to arrive at a sparsity supplement, as is currently done in the FEFP.

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[19] This is done not only to facilitate the analysis, but also to invoke the underlying presumption that the quality of education and all else should be held unchanged when discussing the effects on costs of varying enrollment.

Meaningful results are unlikely to be obtained from subjecting Florida's populous and urbanized districts, Miami-Dade for example, to regressions derived from the Arkansan data. Such large districts are well beyond the range at which even studies arguing for economies of scale have found such economies to be exhausted. In order to avoid such apples-to-oranges comparisons, we also retain as guidance Dodson and Garrett's (2002) conclusion that statistically significant economies of scale are exhausted at an enrollment threshold of 3,500, and hence, largely restrict our discussion to Florida's 15 districts at or below this level, with Glades and Holmes being, respectively, the smallest and largest of such districts.

We do not analyze the effects of enrollment on transportation costs, not only because of Dodson and Garrett's (2002) concerns about the results of that regression, but also because the State currently accounts for transportation costs, by the *categorical funding* section of the FEFP. Accordingly, we sum the estimates of the teacher-salary and supply costs for the 15 districts below our assumed minimum efficient enrollment of 3,500.[20] The regression equations employed for this procedure are presented in Table 4.3.

[20] Comparison of results obtained in this manner with those obtained from estimation via the total-cost regression (not reported) show that this is a valid approach, if only as a very first approximation and only for the purposes of exposition.

Table 4.3 Regressions for Teacher-Salary and Supply Cost Functions

Variable	Teacher Salary	Supply
Constant	-15.535	-9.24
	(10.99)	(23.16)
Enrollment (FTE)	-1.007**	-1.625**
	(0.21)	(0.39)
Enrollment Squared	0.055**	0.092**
	(0.01)	(0.02)
Average Teacher Salary	2.881*	2.496
	(1.17)	(2.55)
ACT Average Composite Score	-0.811	-1.57
	(0.56)	(1.26)
Dropout Rate (in Percentage)	-0.006	0.017
	(0.03)	(0.06)
Percent of Population below Poverty Line	0.002	0.002
	(0.00)	(0.00)
Percent of Students on Reduced Lunch	-0.112	0.125
	(0.22)	(0.43)
Percent of Adults with College Degree	-0.003	0.0005
	(0.00)	(0.01)

Note: Dependent variable is the natural logarithm of per-student costs. Standard errors in parentheses. All variables except those in percentages are in natural logarithms. ** And *** respectively denote significance with 95% and 99% confidence.

A district's estimated per-FTE supplement is calculated by subtracting from the district's estimated per-FTE total (non-transportation) costs from the same estimate for a hypothetical district of 3,500 students, our assumed minimum efficient enrollment. This figure, multiplied by the district's FTE, yields the total sparsity supplement to be received by the district. These results are presented in Table 4.4, which shows that, under our assumptions, the State would have needed to spend well below $5 million in 2002-2003 in order to have met its goal of helping sparsely populated districts provide the required uniform level of education, as opposed to the nearly $30 million actually spent for sparsity among the qualifying districts. Furthermore, this $5 million is but a fraction of the $54 million required by Section 1011.62 (6) Florida Statutes in the absence of prorating. This alone should prompt the State to reconsider its current regime for determining and allocating sparsity aid.

Table 4.4 Estimates of Costs and Supplements

		Estimated Per-Pupil Costs			Estimated Supplement	
County	FTE	Teacher Salary	Supplies	Combined	Per-FTE	Total
Glades	1,022	$2,643	$236	$2,879	$577	$589,945
Lafayette	1,029	$2,638	$236	$2,874	$572	$588,919
Franklin	1,310	$2,495	$218	$2,713	$411	$539,048
Liberty	1,346	$2,481	$216	$2,697	$395	$531,822
Jefferson	1,516	$2,420	$209	$2,629	$327	$496,059
Hamilton	2,032	$2,292	$194	$2,487	$185	$375,167
Gulf	2,121	$2,276	$192	$2,468	$167	$353,208
Union	2,139	$2,273	$192	$2,465	$163	$348,632
Dixie	2,160	$2,269	$192	$2,461	$159	$343,394
Calhoun	2,173	$2,267	$191	$2,458	$157	$340,198
Gilchrist	2,621	$2,204	$184	$2,388	$86	$225,944
Taylor	3,294	$2,140	$178	$2,318	$16	$52,559
Madison	3,299	$2,139	$178	$2,317	$16	$51,219
Washington	3,388	$2,133	$177	$2,310	$8	$28,646
Holmes	3,401	$2,132	$177	$2,309	$7	$25,122
AMEE	*3,500*	*$2,125*	*$177*	*$2,302*	*$0*	*$0*
					Total:	$4,889,881.85

Note that Minimum is Source: BEBR calculations using Dodson and Garrett (2002) regression equations for teacher salary and supply costs. Note that estimated supplement is a district's per-FTE combined cost, less that of the AMEE.

Alternatively it is possible to use the results of Dodson and Garrett (2002), to construct a multiplicative sparsity index to apply to base funding, as is currently done. To do so, we let DGSI denote a sparsity index based on the work of Dodson and Garrett (2002), defined as the ratio of costs relative to costs for the same output in a district of 3,500 students. We set DGSI equal to 1 in districts with over 3,500 students. In smaller districts, working with their results, it follows from an application of algebra that DGSI would take the following form:

$$\text{DGSI} = \alpha_{\text{Salary}} e^{-1.007\ln(N)+.055(\ln(N))^2+4.555} + \alpha_{\text{Supply}} e^{-1.625\ln(N)+.092(\ln(N))^2+7.134} \quad (4.2)$$

In equation 4.2, N represents enrollment and α_{Salary} and α_{Supply} represent the fraction of combined salary and supply costs going to salaries and supplies, respectively, at minimum efficient scale. From the work of Dodson and Garrett, we estimate α_{Salary} to be equal to .92 and α_{Supply} to be .08. This gives:

$$DGSI = .92e^{-1.007\ln(N)+.055(\ln(N))^2+4.555} + .08e^{-1.625\ln(N)+.092(\ln(N))^2+7.134} \qquad (4.3)$$

Based on equation 4.3, Table 4.5 presents the DGSI for 2003-2004, along with comparable indexes of the computed sparsity index, CSI, and wealth adjusted sparsity index, ASI, for 2003-2004, calculated as described in part 2 above, except that, at this stage, the indexes are not rescaled to an UWFTE average of 1. Table 4.5 also shows the resulting sparsity supplements. Lab schools and the Florida Virtual School are omitted, as are all districts receiving no supplements under any of the sparsity regimes. Under DGSI, 15 districts receive supplements totaling $7,785,419. Under ASI, 34 districts receive supplements totaling $29,709,592, while under CSI, 36 districts would receive $55,310,619, if the adjustment were not prorated due to the fact that the adjustment is not funded to the calculated level. Since we strongly recommend dropping the wealth adjustment, the most relevant comparison is between CSI and DGSI. Comparatively, DGSI results in total supplements that are only 14% the level of CSI, leaving the remaining $47,525,200 to be saved or allocated across districts in the form of a higher BSA.

Table 4.5 Alternative Sparsity Indexes and Resulting Supplements

	Indexes			Allocations		
County	ASI	CSI	DGSI	ASI	CSI	DGSI
Baker	1.0279	1.0450	1.0000	$452,507	$730,073	$0
Bradford	1.0397	1.0641	1.0000	$551,941	$890,500	$0
Calhoun	1.1199	1.1934	1.0630	$956,791	$1,543,684	$502,959
Charlotte	1.0000	1.0184	1.0000	$0	$1,234,790	$0
Citrus	1.0176	1.0330	1.0000	$990,374	$1,858,818	$0
Columbia	1.0242	1.0390	1.0000	$843,950	$1,361,627	$0
De Soto	1.0202	1.0326	1.0000	$384,166	$619,813	$0
Dixie	1.0785	1.1267	1.0718	$620,831	$1,001,647	$567,771
Franklin	1.0526	1.1949	1.1746	$258,201	$956,243	$856,601
Gadsden	1.0775	1.1251	1.0000	$1,819,250	$2,935,173	$0
Gilchrist	1.1076	1.1737	1.0321	$1,086,800	$1,753,439	$324,034
Glades	1.1156	1.1910	1.2412	$445,039	$735,570	$928,722
Gulf	1.1015	1.1947	1.0714	$786,568	$1,508,276	$553,268
Hamilton	1.0836	1.1349	1.0817	$610,607	$985,151	$597,064
Hardee	1.0197	1.0318	1.0000	$371,812	$599,881	$0
Hendry	1.0379	1.0611	1.0000	$1,085,166	$1,750,803	$0
Hernando	1.0071	1.0115	1.0000	$501,470	$809,071	$0
Highlands	1.0379	1.0612	1.0000	$1,639,610	$2,645,341	$0
Holmes	1.1188	1.1916	1.0051	$1,417,512	$2,287,009	$60,636
Jackson	1.0745	1.1203	1.0000	$1,918,633	$3,095,516	$0
Jefferson	1.1018	1.1642	1.1544	$527,562	$851,167	$800,147
Lafayette	1.1247	1.2011	1.2465	$452,626	$730,266	$894,950
Levy	1.0814	1.1313	1.0000	$1,840,018	$2,968,679	$0
Liberty	1.1065	1.1718	1.1664	$590,125	$952,106	$922,274
Madison	1.0495	1.0799	1.0087	$577,581	$931,867	$101,432
Monroe	1.0000	1.0769	1.0000	$0	$2,958,786	$0
Nassau	1.0415	1.0724	1.0000	$1,581,989	$2,760,608	$0
Okeechobee	1.0013	1.0021	1.0000	$34,709	$55,999	$0
Putnam	1.0367	1.0592	1.0000	$1,626,208	$2,623,719	$0
Sumter	1.0481	1.0776	1.0000	$1,169,954	$1,887,600	$0
Suwannee	1.0596	1.0962	1.0000	$1,204,270	$1,942,965	$0
Taylor	1.0494	1.0796	1.0092	$576,707	$930,458	$107,276
Union	1.0789	1.1274	1.0704	$605,752	$977,318	$540,253
Wakulla	1.0267	1.0431	1.0000	$460,575	$743,090	$0
Walton	1.0260	1.1260	1.0000	$592,802	$2,874,484	$0
Washington	1.0932	1.1504	1.0023	$1,127,486	$1,819,082	$28,031
TOTAL				$29,709,592	$55,310,619	$7,785,419

Since the economics literature is quite divided regarding scale impacts in education, and since our estimates suggest that the current sparsity supplement is many times too large, the state might wish to err on the side of fiscal stewardship by ceasing to put economically significant sums of taxpayers' funds into an economically unproven program. Additionally, there is no compelling reason why school district borders must correspond exactly to county borders. Therefore, instead of a formulaic sparsity supplement, Florida should consider simply dropping the sparsity supplement in favor of letting smaller districts merge in order to economize on administrative or other costs. If such districts are indeed at a disadvantage, and if there truly are net benefits to greater district enrollment, then they should seek and be permitted to consolidate, either in whole or in part, with neighboring districts, at their mutual discretion. If, instead, the small districts choose not to merge with other districts, we would have revealed preference evidence that that there are no significant benefits to larger district size.

One counter-argument to these concerns is that there is more to the sparsity supplement than simple district size – if students are spread across the county and attend several small schools instead of one large school, school level scale economies might not be realized. This is why enrollment is divided by the number of approved high schools, not in excess of three, in determining the current "sparsity index." We find this counter argument unconvincing for two reasons. First of all, as pointed out by McMahon (1994), making the sparsity supplement dependent on the number of schools, not just district size, distorts decisions regarding the number and placement of schools within a district. Therefore, McMahon argues against such adjustments, and we concur. Second, there are almost certainly sub-sections of several districts with large enrollments and large land areas that are sparse in this sense, but which do not generate sparsity funding for their districts. The more rural areas of Palm Beach and Marion counties come to mind as potential examples.

If the sparsity supplement is not eliminated, the State should strongly consider updating the manner of calculation of the supplement. The regression formula currently used to determine the CSI is nearly a quarter-century old, and has long deserved to be replaced in some fashion, whatever its original merits. Given the present state of findings on economies of scale in schooling, the total sparsity supplement has become unreasonably large, even when prorated. The Legislature has in recent years tacitly acknowledged this failing by funding the supplement at only about 60% of its computed value.

While we earlier employed an adaptation of Dodson and Garrett (2002) to compute a hypothetical sparsity index more consistent with the current research on economies of scale in schooling, that study is not a perfect match for Florida. Better by far would be a detailed econometric analysis of economies of scale in Florida's schools. This would involve properly estimating a cost function holding outputs at a constant level, as best they can be measured. Access to data now being collected on individual student achievement gains, along with other data currently available to the state on school characteristics and performance, much of which the state already posts on the Florida School Indicators Report (http://info.doe.state.fl.us/fsir/), would allow a far better estimation of the degree of scale-impacts in Florida's schools.

Additionally, if the sparsity supplement is retained, a review of the supplement and its calculation, done perhaps every five years in conjunction with the annual construction of the Florida Price Level Index or another part of the FEFP, would ensure that time does not again overtake this program. The case for periodic re-estimation of the supplement's underlying regression is made all the more compelling since the data necessary for estimating production- and cost-functions are increasingly available and are of increasingly better quality. Furthermore, a periodically reviewed supplement could incorporate new statistical techniques and new findings in the economics and education literatures, making the program more efficient and effective over time.

4.4 Conclusion of Sparsity Review

This section of our report reviewed the appropriateness of Florida's sparsity supplement. Given the current understanding of the degree of economies of scale in schooling, and the small number of districts that are below what even those studies that find economies of scale identify as the minimum efficient scale, we recommend dropping the sparsity supplement and allowing small districts to merge with neighboring districts if they so choose. If a sparsity supplement is retained, its basis should be thoroughly revised, based upon a thorough empirical analysis of economies of scale in Florida's schools and districts, and the wealth adjustment should be abolished.

5. Combined Impact of District Cost Differential and Sparsity Recommendations

Before moving on to consider our recommendations on discretionary local millage, we briefly consider the combined effect of our recommendations on the DCD and sparsity. To do so, we present Table 5.1 and Figure 5.1. The first column of Table 5.1 repeats the ECFI described in section 2, the product of the DCD_U, the adjusted sparsity index ASI, and the student resource need index SRI, normalized to have a state UWFTE average of 1. The second column presents a version of the ECFI based on DCD_AS and no sparsity supplement, denoted ECFI*. The third column presents a version of the ECFI based on DCD_AS and a smaller sparsity supplement based on DGSI, denoted ECFI**. The fourth and fifth columns present the respective changes in the ECFI, and columns six and seven present funding changes per UWFTE, assuming the total of $4002 per UWFTE of base funding and sparsity funding used in Table 2.2 is unchanged. This means we are assuming the money saved in the sparsity allocation is allocated to increase base funding. Figures 5.1 and 5.2 depict this effect on funding.

The two alternative EFCIs have considerably narrower ranges and smaller SWMADs than does the current EFCI – that is, they both exhibit considerably less spatial variation. They both also represent considerable funding changes. The UWFTE weighted mean absolute change in funding is $120.13 with the FPLI_AS and no sparsity supplement, and is $119.16 when DGSI is used for the sparsity supplement. The largest gain per UWFTE with no sparsity supplement, $231, accrues to Leon County, and the largest loss, $453, accrues to Holmes County. Using DGSI to proxy a revised sparsity supplement, the largest gain, $529 accrues to Lafayette County, and the largest loss, $437, still accrues to Holmes County. Leon still registers the 6th largest gain, even retaining some sparsity supplement, and Lafayette suffers the third largest loss, $369, if sparsity is entirely eliminated.

Since we think ECFI* and ECFI** are more accurate representations of the cost of providing a uniform education, visual inspection of Figures 5.1A and 5.1B indeed confirms that the FEFP is currently over-compensating the small and very large districts at the expense of medium and large districts, as suggested in section 2. Generally, counties like Alachua, Duval, Leon, Hillsborough, and Orange, that are large, but not extremely large, and which together contain much of the state's population, gain considerably from the changes, whether or not a minimal sparsity supplement is maintained. Many tiny counties gain due to an increase in their DCD if some sparsity supplement is retained and lose if it is not. Small-but-not-tiny counties, such as Holmes and Sumter, gain from an increase in their DCD, but lose more from the loss of the sparsity supplement (since even DSGI gives no supplement for districts with over 3,500 UWFTE).

Table 5.2 tabulates positive and negative changes both with no sparsity supplement and with a sparsity supplement based on DGSI. With no sparsity supplement, 55.9% of the state's students, in 32 districts, gain funding. With a sparsity supplement based on DGSI, 56.3% of the state's students in 40 districts gain from the proposed changes.

Table 5.1 Alternative Education Cost Factor Indexes

County	ECFI	ECFI*	ECFI**	ECFI* - ECFI	Rank	ECFI** - ECFI	Rank	Gain ECFI*	Gain ECFI**
Alachua	0.9568	1.0009	1.0001	0.0441	4	0.0433	9	$176.30	$173.18
Baker	0.9192	0.9358	0.9351	0.0166	22	0.0159	29	$66.44	$63.52
Bay	0.9425	0.9609	0.9601	0.0184	20	0.0176	27	$73.51	$70.51
Bradford	0.9596	0.9573	0.9565	-0.0024	34	-0.0031	42	-$9.43	-$12.41
Brevard	0.9646	0.9895	0.9887	0.0249	11	0.0241	17	$99.57	$96.48
Broward	1.0566	1.0293	1.0285	-0.0274	47	-0.0282	57	-$109.46	-$112.67
Calhoun	1.0050	0.9376	0.9959	-0.0674	60	-0.0091	47	-$269.55	-$36.22
Charlotte	0.9410	0.9493	0.9486	0.0083	29	0.0076	36	$33.20	$30.24
Citrus	0.9321	0.9350	0.9342	0.0029	32	0.0021	39	$11.44	$ 8.53
Clay	0.9305	0.9752	0.9745	0.0448	3	0.0440	8	$179.21	$176.17
Collier	1.0385	1.0608	1.0600	0.0223	15	0.0215	21	$89.25	$85.94
Columbia	0.9252	0.9284	0.9276	0.0032	31	0.0025	38	$12.71	$ 9.81
Miami-Dade	1.0648	1.0094	1.0086	-0.0554	55	-0.0562	64	-$221.75	-$224.90
De Soto	0.9518	0.9450	0.9443	-0.0068	37	-0.0075	45	-$27.19	-$30.13
Dixie	1.0084	0.9432	1.0102	-0.0652	58	0.0018	40	-$260.97	$ 7.04
Duval	0.9546	1.0089	1.0082	0.0543	2	0.0535	7	$217.31	$214.16
Escambia	0.9286	0.9523	0.9516	0.0237	12	0.0230	18	$94.87	$91.90
Flagler	0.9492	0.9416	0.9409	-0.0076	38	-0.0083	46	-$30.36	-$33.29
Franklin	0.9850	0.9356	1.0981	-0.0494	53	0.1131	3	-$197.78	$452.57
Gadsden	0.9918	0.9707	0.9699	-0.0211	44	-0.0218	55	-$84.31	-$87.34
Gilchrist	1.0309	0.9639	0.9940	-0.0671	59	-0.0369	61	-$268.39	-$147.71
Glades	1.0400	0.9439	1.1706	-0.0961	66	0.1306	2	-$384.69	$522.64
Gulf	1.0071	0.9226	0.9877	-0.0845	64	-0.0194	53	-$338.22	-$77.63
Hamilton	0.9890	0.9316	1.0070	-0.0573	57	0.0180	25	-$229.44	$72.15
Hardee	0.9316	0.9282	0.9275	-0.0034	36	-0.0041	44	-$13.49	-$16.39
Hendry	0.9807	0.9627	0.9619	-0.0180	41	-0.0187	51	-$72.02	-$75.02
Hernando	0.9198	0.9461	0.9454	0.0263	10	0.0256	16	$105.23	$102.28
Highlands	0.9696	0.9381	0.9374	-0.0315	50	-0.0322	59	-$125.89	-$128.82
Hillsborough	0.9970	1.0100	1.0092	0.0130	25	0.0122	32	$52.08	$48.93
Holmes	0.9972	0.8842	0.8880	-0.1131	67	-0.1093	67	-$452.55	-$437.35
Indian River	0.9610	0.9686	0.9678	0.0076	30	0.0069	37	$30.47	$27.45
Jackson	1.0066	0.9744	0.9736	-0.0322	51	-0.0329	60	-$128.75	-$131.79
Jefferson	1.0042	0.9476	1.0931	-0.0566	56	0.0889	5	-$226.33	$355.69
Lafayette	1.0059	0.9137	1.1380	-0.0923	65	0.1321	1	-$369.23	$528.57
Lake	0.9401	0.9716	0.9708	0.0315	6	0.0307	12	$125.96	$122.92
Lee	0.9907	1.0124	1.0116	0.0217	17	0.0209	23	$86.71	$83.55

Continued . . .

Table 5.1 Alternative Education Cost Factor Indexes (Continued)

County	ECFI	ECFI*	ECFI**	ECFI* - ECFI	Rank	ECFI** - ECFI	Rank	Gain ECFI*	Gain ECFI**
Leon	0.9714	1.0292	1.0284	0.0578	1	0.0570	6	$231.48	$228.27
Levy	1.0050	0.9543	0.9536	-0.0507	54	-0.0514	63	-$202.74	-$205.72
Liberty	1.1325	1.0614	1.2370	-0.0711	62	0.1046	4	-$284.47	$418.41
Madison	0.9426	0.9238	0.9311	-0.0188	43	-0.0115	50	-$75.35	-$46.09
Manatee	0.9846	0.9816	0.9809	-0.0029	35	-0.0037	43	-$11.79	-$14.85
Marion	0.9464	0.9700	0.9692	0.0236	13	0.0228	19	$94.41	$91.39
Martin	0.9989	1.0120	1.0112	0.0131	24	0.0123	31	$52.28	$49.12
Monroe	1.0700	1.0025	1.0017	-0.0675	61	-0.0683	65	-$270.10	-$273.23
Nassau	0.9533	0.9638	0.9631	0.0105	28	0.0097	35	$41.97	$38.97
Okaloosa	0.9430	0.9615	0.9607	0.0185	19	0.0177	26	$73.86	$70.86
Okeechobee	0.9450	0.9568	0.9561	0.0118	26	0.0111	33	$47.37	$44.39
Orange	1.0003	1.0353	1.0345	0.0350	5	0.0342	11	$140.11	$136.88
Osceola	0.9789	1.0008	1.0000	0.0219	16	0.0211	22	$87.52	$84.40
Palm Beach	1.0579	1.0298	1.0290	-0.0281	48	-0.0289	58	-$112.50	-$115.72
Pasco	0.9629	0.9860	0.9852	0.0231	14	0.0223	20	$92.37	$89.30
Pinellas	1.0109	1.0016	1.0008	-0.0094	39	-0.0101	48	-$37.49	-$40.62
Polk	0.9294	0.9605	0.9597	0.0311	7	0.0303	13	$124.38	$121.39
Putnam	0.9693	0.9670	0.9662	-0.0023	33	-0.0031	41	-$9.19	-$12.21
St. Johns	0.9630	0.9807	0.9799	0.0176	21	0.0168	28	$70.49	$67.43
St. Lucie	0.9517	0.9721	0.9714	0.0204	18	0.0197	24	$81.74	$78.70
Santa Rosa	0.9136	0.9429	0.9422	0.0293	9	0.0286	15	$117.23	$114.29
Sarasota	1.0089	0.9995	0.9987	-0.0094	40	-0.0102	49	-$37.80	-$40.91
Seminole	0.9643	0.9942	0.9934	0.0299	8	0.0291	14	$119.64	$116.54
Sumter	0.9579	0.9392	0.9385	-0.0187	42	-0.0195	54	-$75.01	-$77.94
Suwannee	0.9479	0.9039	0.9032	-0.0440	52	-0.0447	62	-$176.02	-$178.84
Taylor	0.9484	0.9219	0.9296	-0.0265	46	-0.0188	52	-$106.06	-$75.09
Union	0.9715	0.9420	1.0075	-0.0295	49	0.0361	10	-$117.96	$144.33
Volusia	0.9668	0.9783	0.9775	0.0115	27	0.0108	34	$46.21	$43.15
Wakulla	0.9658	0.9817	0.9810	0.0159	23	0.0151	30	$63.61	$60.55
Walton	0.9174	0.8930	0.8923	-0.0245	45	-0.0252	56	-$97.92	-$100.70
Washington	0.9637	0.8897	0.8911	-0.0740	63	-0.0726	66	-$296.08	-$290.61
Minimum	0.9136	0.8842	0.8880	-0.1131		-0.1093		-$452.55	-$437.35
Maximum	1.1325	1.0614	1.2370	0.0578		0.1321		$231.48	$528.57
Range	0.2189	0.1772	0.3491						
SWMAD	0.04141	0.0233	0.02297	0.0300		0.0298		$120.13	$119.16

Figure 5.1A Effect of FPLI_AS and No Sparsity

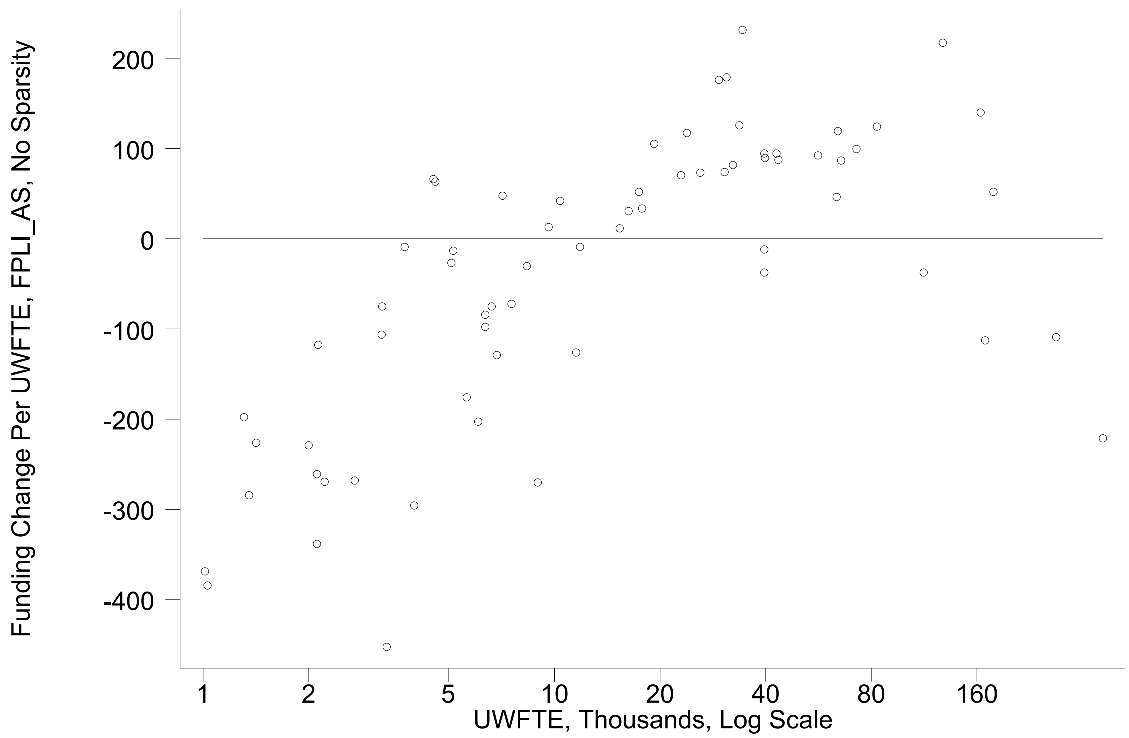

Figure 5.1B Effect of FPLI_AS and DGSI

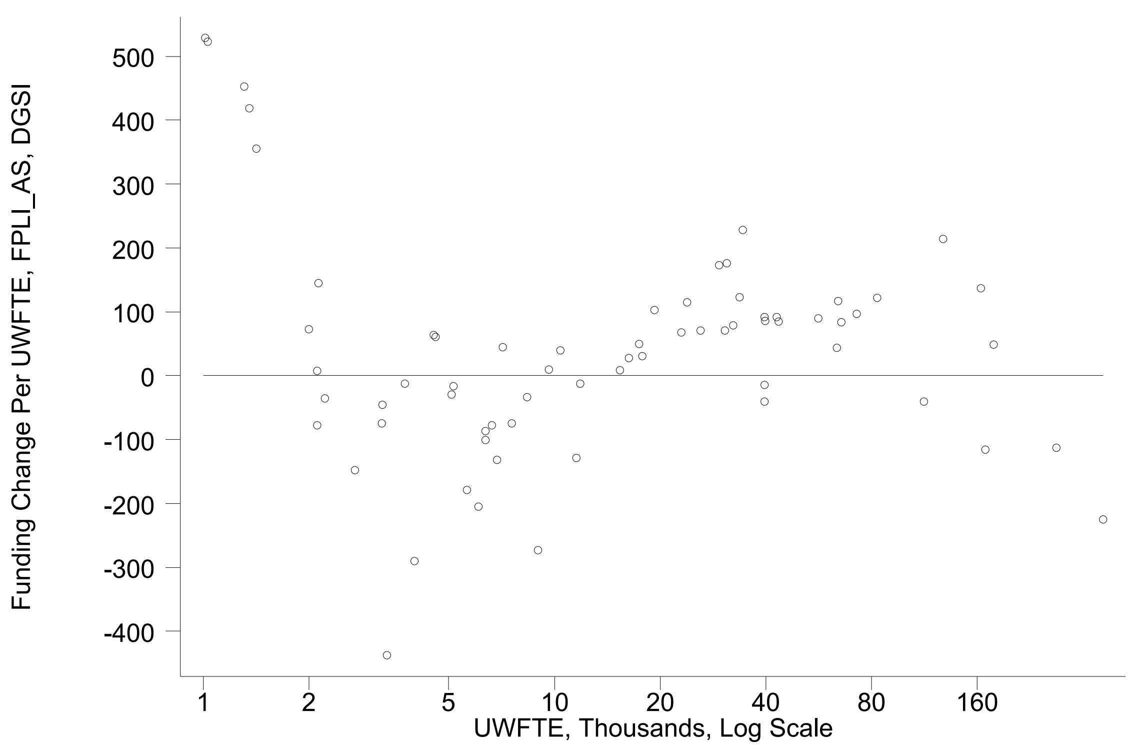

Table 5.2 Effect of Sparsity Changes under DCD_AS

	Estimated Change in ECFI			
	Negative		Positive	
	Number of Counties	Population Share	Number of Counties	Population Share
No Sparsity	35	44.15%	32	55.85%
Reduced Sparsity	27	43.66%	40	56.34%

6. Discretionary Local Millage

6.1. Introduction

Of the $14 billion in total funding for Florida's public schools projected for 2003-04, approximately $605 million, just over 4%, is expected to come from two taxes that may be imposed by local school boards without the approval of residents in a referendum: the maximum 0.51 mill discretionary millage ($480 million) and the maximum 0.25 mill equalized discretionary millage ($125 million). We have been directed to address whether changes should be made to these discretionary millage taxes. We see four major sets of issues involved: (1) legality; (2) equity; (3) local choice; and (4) direct vote versus decision by local school board. We will omit legal issues entirely, and will discuss only the economic aspects of the remaining three sets of topics. We base our recommendations only on the economic aspects, recognizing that those making the decisions should and will take a broader view.

6.2 Efficiency Impacts of Constraining Local Discretionary Millage

One way to introduce the economic issues is to illustrate them through examples, which are admittedly, indeed purposefully, more contrived than realistic, though many of the numbers are approximately correct. For the first example, we choose the Palm Beach school district. Palm Beach has just been selected as the site for the development of a leading biotechnology center, the Scripps Research Institute, which will bring substantial benefits to the state. It is estimated that the accumulated impact over the first 15 years will include an additional $8.9 billion in economic activity, an extra $536 million in state and local revenues, and, by the 15th year an additional 44,000 jobs from direct, indirect, and induced effects. The induced jobs are created by other high-tech and venture firms locating near Scripps.

The schools in the Palm Beach area have been improving rapidly in recent years, and that improvement may have helped Scripps choose South Florida. Nonetheless the 2003-2004 funding per FTE of $5,800 is on the order of 15% below the average for the country, and it is unlikely that the gap will be eliminated in the next few years. As the number of affluent and educated scientists and technicians grows, county leaders come to think that the odds of realizing the full potential of 44,000 additional high-value added jobs in another 15 years will be boosted by having a public school system funded at the national average per student. In attracting those workers, they compete with the Research Triangle Park in North Carolina, near the University of North Carolina-Chapel Hill, Duke, and North Carolina State University. One of the school districts in that area is Chapel Hill-Carrboro, with average spending per student (excluding food for students) in the 2001-02 school year of $8,633. Another is Durham County, at $7,365. They must also compete with Emory and Georgia Tech, both major research universities and served by, among others, the Decatur City school district which now spends over $12,000 per FTE, and Atlanta City at $10,900.

While realizing that quality education requires more than money, Palm Beach's leaders note that the county, partly by virtue of its amenities, is wealthy, and competes with other wealthy areas across the country. They are glad to contribute their share to educating all of Florida's students, but wish they were not hampered in their national competition to become an outstanding bio-tech center by being restricted by the rest of the state to below-national-average K-12 spending. They note that becoming such a center would raise their property values and taxable sales more than in proportion to the increased costs of government. As a consequence, without raising tax rates they would contribute even more than they now do to educating students in the rest of the state.

Some Palm Beach leaders express concern that by increasing spending in their district, already above the average per FTE for Florida, they will exacerbate the inequality across Florida's students. "But wait," a hypothetical Palm Beach Leader might say, "Suppose we increase our spending but *only to the point that we bring it up to the average for the United States*. From a national perspective, we will reduce, not increase, inequality. Let's think of ourselves first as U.S. citizens and second as leaders of Palm Beach, our own community. By raising our funding to the national level, we will be enhancing the education offered the children of our community and at the same time *reducing* national educational inequality. As long as we are contributing our fair share to the rest of the state, why should equalization across Florida take priority over those two goals?"

A second hypothetical example is Collier County. A development corporation that has created several upscale communities near Naples also helped fund the TW&A (2002a) study, which concluded that "Florida's mature residents provided a net public economic benefit to the State of $1.42 billion in 2000," because they paid more in taxes than they received in public services.[21] The net gain from each mature resident, where mature is defined as age fifty and older, was estimated to be $267. The leaders of Naples rejoice in their good fortune in being able to attract many of the nation's most affluent mature residents.

[21] We do not vouch for the accuracy of these estimates.

They then become aware of another study by that TW&A (2002b), using virtually identical methodology, concludes "Louisiana's retirement-age residents provided a net public economic benefit to the State of $319 million in 2000," where "retirement-age residents" are those 55 and older. That turns out to be $356 per older resident.[22] That causes some surprise at first, since Louisiana is a relatively poor state, not nearly as attractive to the affluent elderly as Florida. How can Louisiana extract one-third more net gain from each older resident, when the average household income of the seniors in Florida is 14% higher than that of those in Louisiana? The obvious answer is that Louisiana taxes its seniors more heavily.

Pondering this, our hypothetical Collier County leaders reflect that in the United States, the federal government taxes working-age households and transfers money to the elderly, through Social Security and Medicare. That transfer is roughly balanced by state and local governments, which tax both young and old households about the same but provide more services, especially K-12 education, to younger households. They note that Florida's per capita spending on K-12 education is in the same group as Alabama, Louisiana, Mississippi, North Carolina, and Tennessee, but quite a bit below South Carolina, Texas, and Virginia, and far below Georgia. Perhaps, they think, these latter states got it right. They don't draw in the same proportion of the nation's retirees as Florida, but that could be more than offset by their gaining more from each one, by their keeping to the national arrangement that older households' federal subsidy is offset by their subsidizing education at the state and local level. Though they do not want to kill the goose laying the golden egg, and especially do not want to repel affluent retirees through high taxes, perhaps growing a little more slowly and gaining more revenue from

[22] We do not vouch for the accuracy of these estimates.

each retiree would be a good trade-off. Collier County is rich, and if the state would let it, the school board might be glad to increase spending per student to the national average. Whether as a result Collier would provide more subsidy to the rest of Florida is problematical. Having a better public educational system would raise Collier's property values, but slower growth would lower them.

Duval serves as a final made-up example. With leaders among the most progressive in the nation, Jacksonville has been improving its quality of life in many ways, including education. But in that ascent, it often competes with Savannah, and one of its burdens is that Georgia has become very keen on education. Chatham County, GA, which contains Savannah, spends nearly a sixth more per student and pays its teachers nearly $4,000 more annually than does Duval County. Along with other North Florida counties, Duval faces stiff competition across the border. Their leaders, remembering when Florida held the lead over Georgia in educational spending, might wish to raise property taxes enough to match Savannah dollar for dollar, if the state would let them. If the extra tax revenue were wasted, if the result were higher taxes with no improvement in the quality of education, the result would be a lower property values and a lower Duval contribution to the rest of the state. But Jacksonville's leaders are confident their management skills and strong sense of public spirit will avoid allowing the extra funds to be wasted.

Again, in Duval as in Palm Beach, the issue of increasing state inequality is raised, and again the response is that if the increase is limited to reaching the national average, educational inequality within the United States would be reduced. Moreover, one hypothetical Duval leader might note, "Private schools draw 18% of our students. I don't know the figures off the top of my head, but I'll bet at least 25% of our elementary students attend private schools, and I'll bet further that few of those 25% come from the bottom half of our income distribution. Two-thirds of the boost in spending will aid our children in the bottom half. How can anyone scorn that by calling it disequalizing?"

The point of these examples is that equalization cuts two ways: it brings up those below the average, but it also brings down those above it. Most people realize this, but the second effect is sometimes overlooked. As long as districts contribute their fair share to education across the state, we favor allowing them to increase spending on their own. How much discretion should they have?

Florida is a large and diverse state. Some areas compete locally while for others the arena is national. Some are poor and some are rich. But no district is one hundred percent rich. Even Palm Beach and Collier counties have low-income children. Our view is that no district, simply by virtue of its being located in Florida, should be precluded from increasing its funding per student to the national average. Any districts to do so will benefit all of their public school students, rich and poor alike.

Total equalization is not a possibility. In Clay and, as noted, Duval, which compete with Georgia for teachers, over 18% of all students attend private schools. The private school share exceeds 15% in Escambia, Jefferson, Leon, Miami-Dade, Orange, Palm Beach, and Pinellas. Broward and Sarasota are over 14%. Statewide, the share attending private schools is up from 9.9% in 1993-94 to 12.9% in 2002-03.[23] Most states with which Florida most closely competes have (a) smaller school districts, and (b) wider spending variation across school districts. In Florida the spending range across the 67 counties is under $1,400, with an FTE-weighted standard deviation of $231. Across

[23] Florida Department of Education, Bureau of Education Information & Accountability Services, "Statistical Brief: Florida's Nonpublic Schools, 2002-03," July 2003.

Georgia's 179 districts, the range is over $6,000 and the FTE-weighted standard deviation is $976, allowing that state to offer a wider choice to skilled, prospective residents. A fourth of Georgia's students are in districts in which current spending per FTE exceeds $7,300, and some 90% of Georgia's students are in districts in which spending per FTE exceeds that of the highest district in Florida, Monroe. Only 2.5% of the Georgia students are in districts below Collier. It is not obvious that allowing a wide range of variation across districts has reduced funding for Georgia's poorest students.

A point worth elaborating is that Florida cannot have the degree of within-state inequality that exists in many other states because its school districts are unusually large. Most Florida students find themselves in districts with a wide variety of income levels. In Georgia, for example, the average district has 8,000 students, compared to 38,000 in Florida. More meaningful than doing the averaging over districts is averaging over students. That is, count each student as an individual. For each student, write down the number of students in that student's district. Then calculate the average of that number. The result shows if you pick a student at random, how many students would you expect to be in his or her district.[24] For Florida the answer is 144,000, compared to 40,000 for Georgia. The average Florida student is in a very large district.

In the competition for workforce diversification, Florida handicaps itself by offering almost no public schools whose spending per student matches the national average. It may also, through the politics of equalization, reduce the funding for almost all of its districts, including the poorest. Finally, as long as districts are restricted to spending at no

[24] The formula is $E = \Sigma(N_i^2)/\Sigma N_i$, where N_i is the number of students in district i and the summation is over all districts. The result is E, the "expected" number of students in a randomly selected student's district.

more than the national average, any increase in a district's funding reduces educational inequality nationally.

6.3 Tax Competition between State and Local Governments

State and local governments often compete over the same tax base. If a local government, for example, imposes a local-option sales tax, it induces people to buy slightly fewer taxable goods. As a result the state's revenue from the sales tax declines. In deciding whether to have the local-option tax, local voters or commissioners have little incentive to take account of the resulting loss of state revenue. Suppose Orange County with 5.6% of the state's population raises $100 million in revenue through a local-option tax that causes a $20 million loss in state revenue. The state will have to reduce services or raise other taxes by $20 million. Orange County, however, will experience only 5.6% of that effect, or $1,120,000. The tax raises just over $100 per Orange County resident, which will be offset by a loss of state services (or higher state taxes) of a little over a dollar per Orange County resident.

To continue the example, suppose Orange County spends the $100 million on improving transportation or its public schools. Then it may attract more migrants and higher-income migrants. As the county's overall income rises, its tax base increases. If this effect is strong enough, the Orlando tax could cause the state's tax revenue to rise. If the increase in the tax base stems chiefly from a larger population, the state will have to spend more to maintain the level of service it provides its residents. If the boost to the tax base arises more from higher income per resident, the increased demand on services may not be as large.

6.4. Issues Related to Equalization

The chief argument against allowing variation in spending across districts is that every child should have the same educational opportunity, without regard to the wealth of the district. Discretionary millage creates a positive link between affluence and school spending. Across Florida's districts, for example, each $1,000 increase in income per resident is associated with an extra $10 per FTE of funds from the sum of the two types of discretionary millage.[25] In some parts of the country, poorer districts are more eager than affluent ones to attract factories and warehouses, which boost taxable property. They are more willing to tolerate the noise and non-natural views in order to increase their funds for education.[26] In Florida, however, higher property values tend to be associated with sandy beaches, which attract affluent residents. Across Florida's districts, each extra $1,000 of income per resident is associated with an extra $17,700 of taxable value per FTE.[27] But every affluent district in Florida has poor families. In Collier and Palm Beach, 19% of the children live in poor households. If the district is willing to boost school funding, that will affect children of all incomes. Their schools will be funded closer to the national average.

But if you allow the wealthy districts to increase the funding for their own schools, won't they become less concerned about raising school funding across the state? Won't the result be lower average funding for Florida schools? The evidence on this question is mixed, with no clear conclusion that the political effect of equalization on average funding is either negative or positive.

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[25] Estimated by regressing the funds per FTE from discretionary millage calculated from Florida Department of Education, 2003-2004 FEFP, Third Calculation, on income per resident for 2001 from the U.S. Department of Commerce. The R^2 is 0.47.
[26] Fischel (2001) emphasizes this incentive.
[27] The R^2 is 0.44. Taxable value data are from the *Florida Statistical Abstract, 2002.*

The strongest argument against equalization is that families should be allowed choice. At any income level, some families have a stronger preference for education than others. Those families should have the option of moving to places that charge higher taxes but, in compensation, spend more on education. If the state forbids cross-district variation, families' options are reduced, potentially making Florida a less attractive destination (relative to Georgia or North Carolina, for example) and undercutting the state's other efforts to promote itself.

Since the discretionary millage applies to the property tax, allowing local school boards to raise it, we briefly discuss how that tax relates to the principles of taxation. The aspect of taxes receiving the most attention from voters, aside from their level, is their equity or fairness. Fairness includes vertical equity (the fair allocation of the tax burden across different income levels), horizontal equity (the equal taxation of those with equal incomes), and the benefit notion, i.e., that those who use a public service, such as schooling, should pay for it. Only slightly behind equity, as a public concern, comes simplicity, or reducing the paperwork and time costs of compliance. Economists tend to be most concerned with efficiency, or avoiding waste induced by the structure of the tax system. Analysts who study the workings of political systems add transparency and the encouragement of local institutions to the criteria.[28]

With respect to vertical equity, the residential property tax appears to be roughly proportional, rising roughly in proportion to income since spending on housing rises roughly in proportion to income. In Florida, the progressivity of the property tax is increased through the homestead exemption. The incidence of the property tax on stores

[28] These principles are gathered from Stiglitz (2000), Bruce (2001), Myles (1995), Rosen (2002), and Tresch (1981).

and factories is not well understood, but there is no reason to think it is especially regressive. With respect to horizontal equity, the residential property tax falls more heavily on a household that, with the same income, buys more housing than another. The Save Our Homes amendment adds to the horizontal inequity. People living in identical houses pay differing taxes. It turns the property tax partly into a transactions tax on selling houses.

The horizontal inequities of the property tax are offset for existing owners to the extent that additional spending on education raises property values, with more benefit to those in more expensive houses. The benefit notion is not well satisfied by educational spending funded by the property tax, in the sense that households with no children also pay it, and many of these households consist of elderly residents on fixed incomes. Such residents do benefit somewhat from living in a more educated society and, as noted earlier, part of the nation's bargain with older residents is that they help educate children, and young families help pay for their Social Security and medical care.

Strong virtues of the property tax are simplicity and transparency. Payment occurs once a year and most owners are well aware of it. The chief complexity comes through the appraisal process. But any reasonable additional school millage is not going to add noticeably to the transactions cost of assessing and paying the tax.

With respect to efficiency, the best tax is one on a good that is inelastically supplied or demanded, with land being the standard example. The land will be there whether taxed or not. It cannot move elsewhere to escape the tax. But the property tax falls just as much on buildings as on land, and people can choose how large a house, factory, or store to build, and can decide where to build, a fact resulting in inefficiency. People may buy smaller houses or live farther from where they work in order to reduce these tax payments. Part of the effect of local property taxes is to increase efficiency, however. The federal government subsidizes housing in at least two ways: (1) the implicit rental value of owner-occupied housing is not taxed as income; and (2) mortgage interest is deductible from taxable income. These features of the federal tax code increase spending on housing beyond the efficient level. The result is that property taxes may move spending on housing toward a more efficient level.

Discretionary local property taxes for funding schools could cause inefficiency by inducing retirees to live just over county lines in order to escape the higher taxes. This impact would likely be small, however, for the amount of discretionary millage at issue.

Higher discretionary millage options for school boards would encourage local institution building. It is possible that many or even most residents of Florida – only 35% of the population are native to the state – feel stronger ties to their counties than to the state. The claim that the State of Florida needs to change its educational system is an abstraction to most people. The statements that local schools have classes that are too large or pay teachers too little or are too much under the influence of a union or should offer more art classes are easier for residents of that city to confirm or reject.

With more local authority over discretionary millage, local school board elections would engender stronger interest and perhaps attract better candidates. With the heightened voter interest, school boards would be held more accountable both for the quality of local education and for the millage rate, which should result in decisions providing results closer to what people of the district want. There will of course be logrolling, influence by special interest groups, and simply bad decisions – all part of governance at any level. But local decision-makers have an edge in knowing what voters want and in creating solutions appropriate for their districts.

Other arguments for local decision-making include letting other people or communities do what they want, to the extent they harm no one else, and diffusing political power.[29] An important counter-argument, previously discussed, is that when local school boards consider whether to raise millage rates, they have little reason to weigh any loss of state revenue caused by reduced property values. The expected cost of future tax payments is capitalized into property values. Other things the same, higher tax rates reduce property values, leaving less revenue for the state to distribute through the FEFP. But other things are not necessarily the same. If the revenue results in improved schools, property values rise, thus creating more revenue for the FEFP.

6.5 Referenda and Local Control

Under current rules, the school board can impose the 0.51 and 0.25 discretionary millage through majority vote. Should they be required to submit both millages to public referenda, as is the case with capital spending millages? If they are allowed to increase discretionary millage until the district is at the national average per FTE, should this decision be made at the school board level, rather than by referendum?

The major argument in favor of allowing commissioners to set the millage is the saving of transactions costs. Voters elect board members they trust to run the schools, including determining appropriate funding. Once elected, the members devote their time to doing that right, while the voters go about their lives. Augmenting this argument is the concept of *rational voter ignorance*. The chance that an individual voter will cast the decisive ballot in a millage referendum is virtually zero. In spite of the very small chance

[29] See Netzer (1974).

of affecting the outcome, an individual may vote for the sake of reputation or from a sense of civic responsibility. But since the chance of influencing the outcome is minute, the rational voter will nevertheless spend very little time grappling with the minutiae of the issues. Those who do follow the issues closely will be those with a large stake in the outcome (and presumably a preference for seeing the proposed millage carried or defeated at the ballot box), those with a strong sense of civic responsibility, others who follow issues the same way fans follow sports teams, and still others who fail to understand how low the probability is that they will influence the outcome. There might well be overlap among these groups.

Educational issues can be complex. They involve, among many other considerations, federal and state rules and regulations, matching funds, competition in the market for teachers, changing educational technology, demographic projections, the commercial/residential property tax split, the role of private schools, the gains from higher teacher pay versus the gains from smaller classes, how much teacher pay should be backloaded, what should be the premiums paid teachers for advanced degrees, school zoning, optimal school size, and optimal school location. We should elect people in whom we have confidence and give them the authority they need to meet the responsibility we assign them.

The better the people elected to school boards, the more effective our schools will be. The more power we give local school boards (already severely restricted by state and federal laws and rules), the better will be the quality of the candidates for school boards, and the greater the attention the electorate will pay to selecting the most qualified. The more authority we give school boards over property taxes, the less likely are school boards to be captives of special interest groups and the more likely they are to consist of the people we want to entrust with guiding the education of our children.

6.6 Incentives and Discretionary Millage

Local funding gives schools additional incentive to excel, and excellent schools boost property values, allowing a district to increase its revenue without increasing tax rates. The district's schools are automatically rewarded for good performance with larger budgets, and the school board itself with happier voters. The empirical response to this incentive is not known. One suspects that since discretionary millage provides less than 5% of the budget in a typical Florida district, the size of the effect is not large. A 1% increase in the budget through this mechanism would require a 20% increase in property values. But at least the effect is in the desired direction. Furthermore, if districts were allowed to raise up to the national average per FTE, without equalization, this incentive would become much stronger for those who significantly increased discretionary millage.

The current structure of discretionary millage in Florida creates discontinuous incentives, which may cause minor inefficiencies. The first 0.51 mills can be kept by the district. The second 0.25 mills is more complex. In districts with low taxable property value per student, the 0.25 mills may raise less than $50 per FTE. In that case, the FEFP tops up the revenue to $50 per FTE provided the district imposes the maximum 0.25 mills. Conversely, the district does not retain the entire revenue from the 0.25 mills if its taxable property value per student is high, but must share it with the rest of the state. The combination of the 0.51 maximum, the 0.25 maximum, and the $50 limit create discontinuous budget constraints, which usually result in inefficient decisions. To avoid this, the offending incentives should be phased out continuously, not abruptly. We suspect, however, that the inefficiencies resulting from this aspect are relatively minor, compared to the overall inefficiency derived from prohibiting districts, once they have participated fully in the FEFP, to set whatever millage would bring their spending per FTE up to the national average, should that be their desire.

6.6 Conclusion of the Discretionary Local Millage Review

In summary, we favor (1) requiring each district to participate fully in the FEFP, and (2) once that requirement is met, permitting each school board to assess millage that, subject to remaining within constitutional limits, boosts that district's spending per student (or per FTE) to the estimated national average. Failing that, we favor retaining at least as much flexibility for local districts as the discretionary millage legislation now provides, and think that more would be better. We caution that the issue of local discretion involves non-economic considerations, and that even within economics there is no full consensus (though perhaps a majority view) that allowing local boards more flexibility enhances the efficiency of the educational system and of the overall economy.

We do think with a reasonable degree of certainty that in its effort to diversify employment, Florida is hampered by the large size of its school districts, and that allowing greater local discretion would mitigate the constraint. Furthermore, we think that looking at inequality from a national perspective partially reconciles the conflict between equality and efficiency in school funding.

7. Conclusion

Since the intent of the FEFP is to equalize the amount of real educational resources that can be obtained with non-discretionary funding, a DCD that is an accurate reflection of personnel costs is essential. While the current version of the FPLI, FPLI_U, is a very good spatial price level index, it is not the correct measure to use as a spatial "cost of living" index to adjust school funding across space, as the CPI is used as a temporal cost of living index across years. This is because, while amenities that are not included in a market basket of goods and services, such as warm sunny weather and proximity to beautiful sandy beaches do not vary greatly from one year to the next in a given place, they vary substantially from one place to another in a given year. Thus, an amenity-adjusted price level index is needed to proxy as a spatial cost of living index for the DCD. We develop an amenity-adjusted and statistically and geographically smoothed version of the FPLI, which is also adjusted to be appropriate for occupations with the work place location characteristics of school personnel, which we dub FPLI_AS. We recommend using FPLI_AS, rather than FPLI_U, as the basis for the DCD.

The theoretical and empirical case for continuing the sparsity supplement is much weaker. While there is theoretical reason to expect there may be some degree of economies of scale, the empirical evidence is mixed as to their extent. The best recent empirical work indicates that there may be economies of scale, but they will be exhausted by the time a district reaches 3,500 UWFTE. Further, even given this evidence, it is not theoretically clear that a sparsity supplement is needed for districts under 3,500 UWFTE. This is because, absent the sparsity supplement, districts could consolidate entirely, or, just consolidate certain functions, if being larger is actually an advantage. We recommend doing away with the sparsity supplement. If a sparsity supplement is retained, we recommend reducing it greatly and basing it on a modern econometric analysis, to be updated every five years. If a sparsity supplement is needed, we also recommend dropping the wealth adjustment, which results in treating two counties that differ only in their measured sparsity differently with respect to their ability to raise discretionary funding beyond the base level of the FEFP.

Currently, Florida spends well under the national average per student on preK-12 education. Capping discretionary millage, therefore, not only lowers Florida's average spending, but also increases national inequality of education spending while decreasing within state inequality. Further, the spread of education spending in Florida is below that of most states with which Florida competes, meaning Florida offers families less choice among tax and service packages than other relevant states. Equalizing and capping discretionary local millage may, therefore, make Florida less attractive to affluent skilled workers and, therefore, less attractive to the types of firms that hire them. In addition to eliminating choice for parents and potential workers, limiting unequalized discretionary millage reduces incentives for efficient operation of schools since such efficiency increases property values, but little of that translates into additional revenue for the local district with such small unequalized discretionary millage rates. Combined, these effects of equalizing and capping discretionary millage may actually reduce the state's aggregate tax base and, therefore, may conceivably reduce funding for the poorest districts. Therefore, assuming an adequate level of base funding is provided, we recommend that districts be allowed to raise discretionary millage until local funding equals the national average per UWFTE, subject to constitutional limits. If this is not feasible, we recommend increasing the unequalized component of discretionary millage as much as is feasible.

Together, our recommendations on the DCD and the sparsity supplement move the FEFP toward providing a more nearly equal real level of educational resources through non-discretionary sources. They also reduce nominal variation in spending across districts. However, they result in shifting significant amounts of funding between districts.

Our recommendations concerning discretionary local effort would allow considerably increased variation across districts in funding. However, they would likely increase Florida's average spending and would thus reduce national funding inequality. They would also provide families with more choices as to the type of community they would prefer to live in and enhance local incentives to operate schools efficiently.

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