Innovating Toward Sustainability: How Computer Labs Can Enable New Staffing Structures, and New Savings

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For a long time, even as new educational technologies have emerged, staffing innovations have seemed all but impossible in American schools. Even in charter schools, which don't have the typical labor constraints traditional schools do, technology has merely been a layer added to schools' existing personnel structure, rather than a catalyst for delivering education—and staffing schools—in fundamentally new ways. Charter and district schools alike long ago surrendered to the notion that education requires at least as many core teachers as is determined from dividing enrollment by class size.

But does it? Or are there ways of organizing instruction so that schools need fewer teachers?

Finding an answer to these questions is more important than ever. Resources for public education are likely to be highly constrained for years. Even as revenues climb from year to year, those increases won't be sufficient to cover the steady growth in labor costs, as salaries rise to keep pace with other fields and as benefit and retirement costs creep up. With staffing costs set to escalate faster than revenues, schools are likely to cut services, with students receiving less and less. As one Colorado superintendent put it, "We can cut and cut and cut, but that only works for so long, since we'll always need a teacher for every classroom."

However, that's not necessarily the case. A few new school designs suggest that we can fundamentally alter the basic schooling model, so that a given number of students can be taught—and taught well—by fewer teachers, who are leveraged in new ways. While some tasks require new technology and thus new technology staff, these new school designs are just as much staffing innovations as technological ones.

The innovations come with the promise of fundamental cost redesign. If schooling could indeed be reorganized to rely on a different mix of staff (typically, fewer teachers offset by more, lower-salaried lab aides), then district and charter leaders could alter the cost curve. They could step off the cycle of cost escalation and budget cuts that have consumed them in recent years, and onto more financially sustainable footing.

Of course, any large-scale adoption of these new school designs should depend most on whether the models are effective with students. Even if they are, many states have formidable barriers to staffing innovations, including funding formulas rigidly tied to student-teacher ratios. Policymakers are unlikely to let go of some of those barriers without relevant evidence of what such reforms might mean for their states. This report provides that evidence. Using real wage and staffing data from each state, we project the financial and staffing implications of one innovative model—the Rocketship lab rotation—to highlight potential implications for the schooling workforce and total per-student spending.

Rocketship Education is a California-based network of charter schools that rely on blended learning. One-quarter of each day's instructional time is spent in a computer lab, staffed by an instruc-

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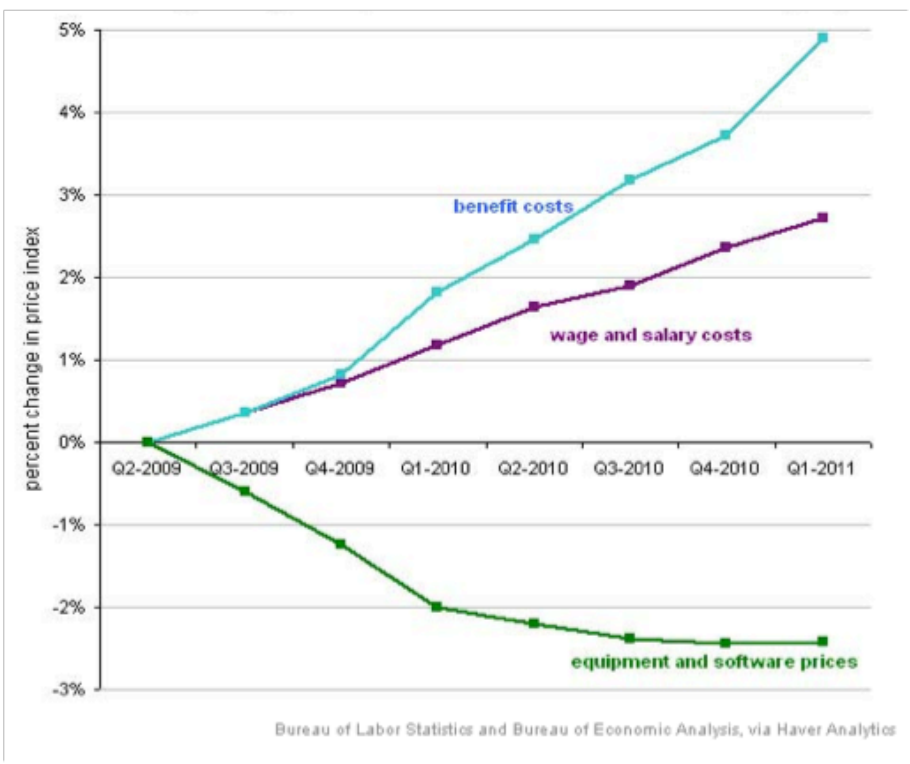
tional aide instead of a classroom teacher. Money saved on staffing is reinvested elsewhere.[1] This specific model is clearly not a solution for all schools, districts, or states. But it illustrates the extent to which staffing innovations can change cost structures and offer greater financial sustainability. If all public elementary schools adopted it, states could unlock nearly $10 billion in funds to reinvest elsewhere for students and achieve the financial sustainability that would otherwise elude them. Of course, universal adoption of lab rotations is implausible—but there is no reason to think it could not be embraced on a far larger scale than it is now. This innovation, and others like it, should be given serious consideration, before our current cost structures begin to deteriorate the quality of schooling.

Reducing the Quickest-Rising Costs

Schooling, of course, is and likely always will be a labor-intensive enterprise. Over the last decade, school reform efforts have hinged on adding more and more staff to schools. From 2002 to 2008, the number of public elementary and secondary teachers increased by 10 percent, faster than student enrollment growth.[2] And some projections suggest staffing will continue to grow.[3] As Figure 1 illustrates, among the production inputs typical in education, cost escalation has been highest for benefits (particularly health benefits), followed by salary and wages. On the flip side, the prices of technology, equipment, and software have effectively fallen.[4] As long as reforms continue to rely on the addition of labor, labor costs will likely rise faster than public revenues.[5]

Figure 1. Personnel costs have climbed as equipment prices dropped



Source: Catherine Rampell, "Man vs. Machine," *New York Times,* June 10, 2011.

1 . Heather Staker and Michael Horn, *Classifying K-12 Education* (Innosight Institute, 2012) defines "Lab Rotation."
2. NCES Digest of Education Statistics: 2011, Table 4.
3. *Projections of Education Statistics to 2020* (National Center on Education Statistics, 2011).
4. Catherine Rampell, "Man vs. Machine," *New York Times,* June 10, 2011.
5. Paul Hill and Marguerite Roza, *Curing Baumol's Disease: In Search of Productivity Gains in K–12 Schooling* (Seattle: Center on Reinventing Public Education, 2010).

But the precise mix of labor in schools need not be fixed in stone, as Rocketship and other innovative schooling networks have shown. With financial sustainability a critical issue, school designs that rely less on high-cost labor and more on technological innovations might prove more viable over the long haul. The recent explosion of technology-based options in schooling, and the falling price of technology, suggest that the timing is ripe for more innovations that rethink staffing. New content providers that customize learning for individual students, including lower-cost (or free) products, such as those offered by Khan Academy and CK-12 Foundation, are increasingly accessible for use in schools.[6]

Even as these promising tools proliferate, most forward-thinking schools and school networks, including most charters, have yet to fundamentally change their staffing structure. Many still rely on the basic personnel model used by traditional schools, and instead offer improvements in staff effectiveness, performance management, and school culture. While some of these strategies have indeed yielded improved outcomes for students, the schools' spending patterns look similar to those of traditional schools, with similarly problematic cost structures.[7]

Rocketship: Fewer Teachers, Growing Learning

Rocketship provides a notable exception.[8] The charter network operates K-5 charter schools in San Jose, California, where about 90 percent of students come from low-income families and 75 percent are English language learners. Rocketship schools outperform schools with similar demographics, and even some that are more affluent.[9]

Figure 2 shows how Rocketship's lab rotations change the traditional staffing structure. Say a 3rd grade has four classes. At the typical elementary school, each of those classes would be assigned its own dedicated teacher, who teaches all subjects—four teachers for four classrooms. Rocketship assigns only three teachers for those four classrooms, as well as one lab aide for every 70 students. Classroom teachers specialize: Each of two humanities teachers covers two classrooms, while one math and science teacher splits time among all four classrooms. Students spend 25 percent of their time in a computer lab, called the learning lab, supervised by uncertified staff. During the learning lab, students work on math and literacy software programs, get individual tutoring as needed, and take time out to participate in other special classes, including physical education and art.[10]

On the face of it, each teacher has an increased student load. But because teachers specialize, they do not need to prepare for as many subjects.[11] As well, the learning lab software removes the need for some tasks, such as assigning and grading basic math problems and individualized literacy work. In this manner, a single teacher reaches one-third more students, while non-certified instructors, computers, and the students themselves take on a portion of the previous responsibilities, and costs, of the teacher. This reduced reliance on teachers enables the school to hire more selectively and spread scarce math and science expertise across more students.

6. Jennifer Belissent, *Schools Move Beyond The Basics: Competition Will Drive Technology Into The Education Market* (Forrester Research Inc., 2011).
7. Robin Lake et al., *The National Study of Charter Management Organization (CMO) Effectiveness: Report on Interim Findings* (Seattle: Center on Reinventing Public Education, 2010).
8. Others pioneering blended learning with new staffing models include Carpe Diem Schools in Arizona and KIPP Empower Academy in Los Angeles.
9. Based on the 2012 California Academic Performance Index (API) reported by Rocketship Education at www.rsd.org.
10. For an in-depth case study of Rocketship, see "Blended Learning in Practice: Case Studies from Leading Schools," prepared by FSG for the Michael and Susan Dell Foundation, 2012.
11. *Subject Specialization (Elementary) School Model* (Public Impact and opportunityculture.org, 2012).

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Figure 2. Switching up staffing

Traditional elementary school: four teachers for four classrooms

	3rd Grade Class 1	3rd Grade Class 2	3rd Grade Class 3	3rd Grade Class 4
1st Period	Teacher A	Teacher B	Teacher C	Teacher D
2nd Period	Teacher A	Teacher B	Teacher C	Teacher D
3rd Period	Teacher A	Teacher B	Teacher C	Teacher D
4th Period	Teacher A	Teacher B	Teacher C	Teacher D

Rocketship lab rotation: three teachers, plus lab staff

		3rd Grade Class 1	3rd Grade Class 2	3rd Grade Class 3	3rd Grade Class 4
8 AM start	1st Period	Teacher A	Teacher C	Teacher B	Learning Lab
	2nd Period	Teacher A	Learning Lab	Teacher B	Teacher C
	3rd Period	Teacher C	Teacher A	Learning Lab	Teacher B
4 PM end	4th Period	Learning Lab	Teacher A	Teacher C	Teacher B

Teacher A	Teaches Humanities
Teacher B	Teaches Humanities
Teacher C	Teaches Math/Science
Teacher D	N/A
Learning Lab	Teaching Aides and computers

Freeing Funds for Reinvestment

The Rocketship lab rotation model produces a substantially different cost structure than what is typical nationally. In a traditional public school district, salaries and benefits together consume 60–80 percent of the budget, on average.[12] At Rocketship, that total is about 47 percent.[13]

It is important to note that Rocketship schools haven't simply used technology to reduce overall staff, but rather made a shift in staffing to rely on a different *mix* of staff: fewer classroom teachers, more technology staff. That mix has allowed Rocketship to reinvest some funds, enabling schools to operate with a longer school day and pay teachers salaries above market rate.

Determining the cost implications of Rocketship's lab rotation model across different school settings requires some isolation of the features that might be more broadly adopted. While this report focuses on the implications of the subject specialization and lab rotation structure, there are other elements of the Rocketship design that affect its schools' cost structure. For instance, Rocketship schools have larger class sizes than the national average and deliver their non-core electives differently.[14] Rocketship also remands some administrative tasks to parents, who are asked to volunteer 30 hours per year. While these additional features may not be scalable across other settings, the basic staffing innovation could be. So we analyzed this question: Leaving class sizes and administrative structures as is, what if more schools simply adopted the concept of having four classrooms taught by three teachers, along with a lab rotation?

Keeping constant national norms for elementary school class sizes, Table 1 demonstrates the staffing and cost implications of adopting this staffing innovation for grades 1 though 5.[15] Current core staffing costs are based on state average salaries for elementary teachers, and benefits are included as a projected 33 percent of salary costs.[16] The lab rotation assumes using 25 percent fewer core teachers and one technology aide per 70 students, whose total compensation we based on the national average for paraeducators (at 38% of average teacher earnings).[17]

As is clear from Table 1, the rotation model relies on fewer teachers and more lab aides; for every 1,000 students, the system uses 12 fewer teachers but adds 14 more lab staff. While the number of total jobs increases, the per-pupil staffing costs drop by $525 per pupil (or about 5 percent).[18] That enables some investment in necessary lab equipment and software, with additional funds available for other reforms.

12. Marguerite Roza, Noah Wepman, and Cristina Sepe, *The Promise of Cafeteria-Style Benefits for Districts and Teachers* (Seattle: Center on Reinventing Public Education, 2010).

13. Rocketship Education and its affiliates, "Consolidated Audited Financial Statements for the Year Ended June 30, 2011."

14. *CCD Build a Table, retrieved 2012* (National Center on Education Statistics).

15. *Ibid.*

16. Average salaries are from NEA Research, *Rankings & Estimates: Rankings of the States 2010 and Estimates of School Statistics 2011* (National Education Association, 2010). Benefits and salary costs are from *Revenue and Expenditures for Public Elementary and Secondary Education: School Years 2007-2008* (National Center on Education Statistics).

17. *ESP Average Salaries: 2010-11 Average Salaries for Full-time K-12 and Higher Education ESP Labor Force* (NEA Research, 2012); retrieved at http://www.nea.org/home/13566.htm.

18. Of the average $11,467 per-pupil spending in 2012 reported by NCES, "Fast Facts, 2012 Back to School Statistics."

Table 1. Rotation model frees up funding, even at current class sizes

	Average class size*	Core classroom teachers required *per 1,000 students*	Lab aides required *per 1,000 students*	Total teachers plus lab aides *per 1,000 students*	Staff cost at current compensation levels for core teachers and lab aides** *per pupil*
Traditional model (1 teacher per classroom)	20.1	49.75	-	49.75	$3,710.04
Lab rotation model	20.1	37.31	14.29	51.60	$3,185.02
Change if shifted to lab rotation model	0	-12	14	2	-$525.01

* Kept at current national average for elementary students.

** Benefits are assumed to be 33 percent of base salary.

Clearly, implementing the lab rotation model comes with additional implications for schools. First, since these schools utilize teachers differently, they may need a different mix of teacher expertise (namely, elementary teachers able to specialize in math/science or in humanities). Second, there will certainly be cultural challenges that come with changing practices in organizations that have run things the same way for a long time.

Third, the lab experience requires that schools assemble their computers in a single location, and purchase relevant software to enhance learning. The costs for equipment and software to transition to this model will depend on both software choices and the extent to which a school already has appropriate computers. In 2008, the most recent year for which data are available, the ratio of students to instructional computers with internet access was 3.1 to 1.[19] The lab rotation model demands even fewer computers than that, because a computer is needed only for every four students. Some schools may not necessarily have to buy more computers, but rather rearrange them. How much schools now spend on software varies widely, and it's unclear how much they'll have to spend to adopt the new model. With the educational technology sector still in transition and many free options available, technology costs are expected to grow more slowly than labor costs and have been left out of these projections.

Nearly $10 Billion to Grow On

All told, our analysis shows that a universal shift to the lab rotation model in U.S. elementary schools would yield $9.8 billion for reinvestment elsewhere in education. The financial implications differ by state, given the variance in teacher salaries and the number of teachers per student. As Table 2 demonstrates, if all public elementary schools moved to Rocketship's lab rotation model, and class sizes remained the same, the country could operate with 230,149 fewer teachers, offset by 263,664 more lab aides. That would free up $531 per student on average, and far more in some states. In New York, for example, the model would make available $943 per student, for a total of nearly $1 billion.

19. *Educational Technology in U.S. Public Schools: Fall 2008* (U.S. Department of Education, National Center for Education Statistics, 2010).

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Table 2. Staffing and cost changes if states shifted to the lab rotation model for elementary schools

State	Total change in # of teachers	# of additional lab aides needed	Added # of new jobs	Funds available to reinvest	Funds freed up per elementary student
USA	**-232,564**	**263,674**	**31,110**	**-$9,805,828,613**	**-$531**
AK	-654	710	56	-$33,128,252	-$667
AL	-3,844	4,160	317	-$129,594,929	-$445
AR	-2,325	2,635	311	-$75,032,641	-$407
AZ	-4,478	6,010	1,532	-$113,856,476	-$271
CA	-26,948	33,086	6,139	-$1,556,331,903	-$672
CO	-3,745	4,544	798	-$120,739,768	-$380
CT	-2,656	2,952	295	-$148,506,625	-$719
DC	-320	348	28	-$18,518,603	-$761
DE	-572	698	126	-$24,416,810	-$500
FL	-13,749	14,339	590	-$449,978,756	-$448
GA	-9,218	9,266	48	-$399,799,448	-$616
HI	-856	1,008	152	-$34,302,135	-$486
IA	-2,191	2,504	313	-$76,994,225	-$439
ID	-1,140	1,542	402	-$28,462,677	-$264
IL	-8,962	10,957	1,995	-$442,281,557	-$577
IN	-4,696	5,717	1,022	-$153,722,953	-$384
KS	-2,298	2,559	261	-$71,803,132	-$401
KY	-2,906	3,668	763	-$85,659,312	-$334
LA	-3,776	3,905	129	-$139,261,920	-$509
MA	-4,718	5,054	336	-$303,200,711	-$857
MD	-3,786	4,374	588	-$204,648,920	-$668
ME	-1,005	973	(32)	-$35,638,123	-$523
MI	-5,983	8,372	2,389	-$230,370,269	-$393
MN	-3,264	4,352	1,088	-$108,365,374	-$356
MO	-4,395	4,860	465	-$134,349,277	-$395
MS	-2,509	2,767	258	-$78,267,340	-$404
MT	-733	763	30	-$24,460,458	-$458
NC	-7,560	8,397	836	-$234,512,662	-$399
ND	-521	488	(33)	-$16,911,513	-$495
NE	-1,446	1,557	111	-$47,535,540	-$436
NH	-947	1,027	80	-$37,560,721	-$523
NJ	-6,315	7,141	827	-$355,699,317	-$712
NM	-1,709	1,839	129	-$54,923,906	-$427
NV	-1,959	2,410	451	-$70,242,069	-$416
NY	-13,423	13,783	360	-$909,657,853	-$943
OH	-7,829	9,479	1,649	-$329,516,940	-$497
OK	-3,126	3,519	393	-$104,734,333	-$425
OR	-2,292	3,046	754	-$86,050,539	-$404
PA	-7,817	9,299	1,482	-$367,394,139	-$564
RI	-634	750	115	-$30,269,076	-$577
SC	-3,707	3,917	210	-$133,345,908	-$486
SD	-647	660	13	-$11,698,970	-$253
TN	-5,319	5,382	63	-$181,160,053	-$481
TX	-26,336	26,591	255	-$927,032,600	-$498
UT	-2,446	3,350	904	-$57,113,637	-$244
VA	-6,407	6,658	251	-$251,748,937	-$540
VT	-472	452	(19)	-$18,716,575	-$591
WA	-4,239	5,533	1,294	-$147,414,058	-$381
WI	-3,851	4,315	464	-$144,915,253	-$480
WV	-1,384	1,474	90	-$45,459,968	-$441
WY	-453	484	31	-$20,521,451	-$605

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Of course, it's unlikely that this innovation would be appropriate for every school in the country. Some might be too small to benefit from the model, or have a particular student population for whom the approach may not be a good fit. It is worth noting, however, that the lab rotation model isn't just intended for special schools or unusual student populations. Rather, the model is intended for typical elementary schools, including those with substantial numbers of low-income or bilingual education students. Toward this end, the analysis highlights the potential relevance of such an innovation for the larger cost and staffing structure of states, and how much money is at stake.

The costs of salaries and benefits are likely to grow faster than technology costs, leaving schools vulnerable as budgets flatten. At a time of profound revenue constraints, it is worrisome to see how few schools have embraced innovative staffing structures that leverage technology, and that are in many cases producing great outcomes for students. Rather than zero in on financially sustainable models, charters and other innovation schools have sought improved student outcomes often *at any cost.*

Many of their strategies are helping students, it's clear. But it is also clear that schools won't be able to continue their current approaches forever, unless they explore models that can be scaled and sustained across a larger set of schools. School and network leaders should be actively investigating the potential of new staffing innovations that will move them toward greater financial sustainability, and those promoting education reforms and innovations should lend support for these efforts. Furthermore, federal, state, and private grants ought to prioritize staffing innovations, as these reforms may indeed hold more practical promise going forward.

Finally, despite how much money these models could free up, most state policies are still a long way from enabling their adoption, in part because the state regulatory environment can be prohibitive. Staff-to-student ratios, formulas that dictate resource use, seat time regulation, salary schedules, and other such requirements inhibit even considering these kinds of models. Where states are serious about seeking innovations that alter the cost curve, they'll need to remove these constraints—likely replacing process-based regulation with systems that manage schools based on outcomes measures. And, more importantly, these models will require more flexibility in how funds are applied.

For districts, it means moving away from rigid one-size-fits-all school models, and seeking purposeful variation in school design. Schools with staff attrition might be the first to try out new models as a vacant position provides some opportunity to rethink the school's delivery model. Where relevant, districts would also need to relax rigid work rules and school day scheduling requirements to accommodate redesigned service delivery models.

The Rocketship lab rotation is just one model—there will be many more. As individual innovators continue to break the mold on how schools can be staffed and children can be educated, we will see if states and districts are up to the challenge of rethinking schooling to create more financially sustainable options. For public education, there is much at stake. Without such improvements in delivery, the likely alternative is one where public education faces a decade of erosion in services.

Appendix A. Cost factors used in the analysis in Table 2

State	Current # of core teachers	Total core teachers needed with Rocketship Lab Rotation staffing	Class size	Current core teacher staffing cost	Rocketship staffing cost
AK	2,616	1,962	19.00	$212,521,164	$179,392,912
AL	15,374	11,531	18.94	$987,247,308	$857,652,378
AR	9,299	6,974	19.84	$597,124,313	$522,091,672
AZ	17,910	13,433	23.49	$1,132,741,341	$1,018,884,865
CA	107,790	80,843	21.49	$9,954,121,396	$8,397,789,493
CO	14,981	11,236	21.23	$995,027,364	$874,287,596
CT	10,626	7,969	19.44	$926,660,463	$778,153,838
DC	1,278	959	19.03	$113,248,541	$94,729,938
DE	2,289	1,717	21.35	$176,358,430	$151,941,619
FL	54,994	41,246	18.25	$3,415,905,874	$2,965,927,118
GA	36,871	27,653	17.59	$2,643,484,934	$2,243,685,486
HI	3,424	2,568	20.60	$250,762,321	$216,460,186
IA	8,763	6,573	20.00	$590,155,574	$513,161,350
ID	4,561	3,421	23.67	$287,632,383	$259,169,705
IL	35,848	26,886	21.40	$3,003,964,637	$2,561,683,080
IN	18,783	14,087	21.31	$1,259,207,409	$1,105,484,456
KS	9,192	6,894	19.49	$575,579,983	$503,776,851
KY	11,623	8,717	22.09	$756,048,939	$670,389,627
LA	15,106	11,329	18.10	$997,183,498	$857,921,577
MA	18,871	14,153	18.75	$1,782,408,744	$1,479,208,033
MD	15,145	11,359	20.22	$1,311,548,629	$1,106,899,710
ME	4,020	3,015	16.95	$252,245,533	$216,607,409
MI	23,932	17,949	24.49	$1,865,037,959	$1,634,667,690
MN	13,054	9,791	23.34	$923,910,921	$815,545,547
MO	17,578	13,184	19.35	$1,085,058,927	$950,709,650
MS	10,036	7,527	19.30	$624,918,430	$546,651,090
MT	2,933	2,200	18.21	$183,845,567	$159,385,109
NC	30,241	22,681	19.44	$1,884,341,282	$1,649,828,620
ND	2,083	1,563	16.40	$122,657,597	$105,746,084
NE	5,784	4,338	18.84	$365,575,675	$318,040,135
NH	3,788	2,841	18.97	$265,949,212	$228,388,492
NJ	25,259	18,944	19.79	$2,227,605,732	$1,871,906,414
NM	6,836	5,127	18.82	$426,892,516	$371,968,610
NV	7,835	5,877	21.53	$552,558,088	$482,316,019
NY	53,691	40,268	17.97	$5,191,979,394	$4,282,321,541
OH	31,317	23,488	21.19	$2,386,300,192	$2,056,783,253
OK	12,503	9,377	19.70	$815,484,443	$710,750,110
OR	9,167	6,875	23.26	$687,482,945	$601,432,406
PA	31,270	23,452	20.82	$2,517,602,079	$2,150,207,941
RI	2,537	1,903	20.68	$205,552,165	$175,283,089
SC	14,827	11,120	18.49	$974,847,686	$841,501,778
SD	2,589	1,942	17.85	$121,227,049	$109,528,080
TN	21,276	15,957	17.71	$1,331,198,465	$1,150,038,412
TX	105,345	79,009	17.67	$6,704,911,147	$5,777,878,548
UT	9,784	7,338	23.97	$605,992,576	$548,878,939
VA	25,627	19,220	18.19	$1,757,319,131	$1,505,570,194
VT	1,887	1,415	16.78	$125,840,002	$107,123,427
WA	16,957	12,717	22.84	$1,213,223,966	$1,065,809,908
WI	15,404	11,553	19.61	$1,065,988,880	$921,073,627
WV	5,536	4,152	18.63	$347,920,991	$302,461,023
WY	1,814	1,360	18.69	$136,678,751	$116,157,300

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