The Case for Increasing Enrollment and Leveraging Marginal Costs: CSUN Case Study

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Abstract
The California State University System (CSU) is facing and ever decreasing state allocation and must take steps to achieve financial stability while fulfilling its mission. There are two conflicting strategies: growing by increasing efficiency and taking advantage of economies of scale or reducing enrollment to keep a balance between state allocations and fee revenue. This study will investigate these two strategies and will come to the conclusion that growth is the better alternative at the given fee levels. The first part of the study will estimate the marginal cost for increasing enrollment from a theoretical point of view. This analysis will use data from the IPEDS data base and formulae for replacement costs suggested by the Legislative Analysts Office. The second part will do the same, but using actual data from California State University, Northridge's Financial Statements and Office of Institutional Research.

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Theoretical Marginal Cost

Knowing how much instruction costs or could cost will not solve the supply problem-how much general fund the state has. Nor will it answer the riddle of demand-how much price students/families tolerate. But the knowledge can help. By breaking down and comparing categories of cost, we can assess what reductions are possible, with what effects. Presumably, we then can re-aggregate these categories into a generalized cost of instruction; this figure then can inform the debates about funding.

This report is conservative in assumptions and methods. It does not project an ideal cost by imagining completely new models for higher learning and its business. Nor does it advocate for a new measure for funding, as in graduates per FTES. Rather, it identifies distinctive practices in nearly 400 BA, MA, and R2 universities like the CSU. And it does so through marginal and full cost of instruction calculations, using IPEDS [1] data from '06-07 to '09-10. The drawback is that this approach relies on what was to guide what might be; this is, however, offset by the variety of practices across the institutions.

In addition to IPEDS categories, the report includes these indices to cost:

Replacement: the campus-averaged cost of adding/replacing a tenure-track faculty, figured as the mean between assistant professors and lecturers/instructors with benefits at the rate in Instruction. This sum then is divided by the SFR so it can be expressed as an amount per FTES.

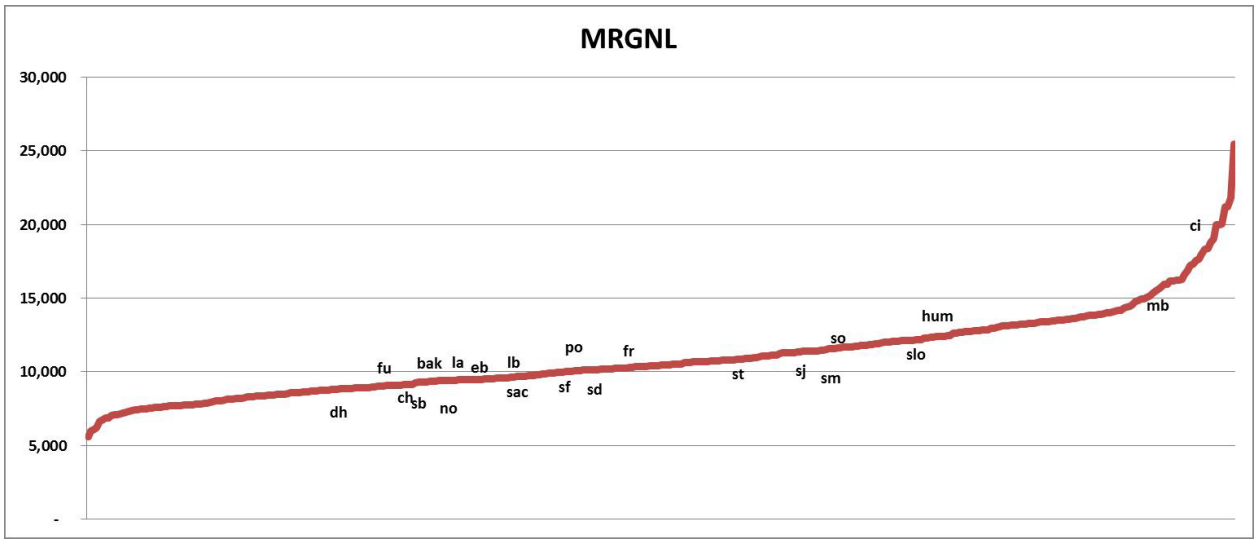
Marginal: replacement cost plus support; excludes research. The figure includes 90% of the remaining cost for Instruction, 80% of Academic Support, 65% of Student Services, and 60% of Institutional Support. According to the LAO, these percentages exclude fixed costs that are relatively insensitive to demand. The numbers are summed over FTES. Comparisons require a formula because detailed expenditures are not readily accessible across institutions. A fixture of annual allocations linked to enrollment growth, a marginal increase does not account for changes in ongoing costs.

Marginal and Discount: factors in the fees not collected as a discount or grant-the SUG in CSU; does not include share that goes to auxiliaries for books, supplies, room, board, etc.

Full: 100% of the categories under Marginal and of Public Affairs and Research, as well as the whole Discount-all normalized over FTES. Does not capture either irregular costs such as capital or auxiliary expenditures.

The full data sets are attached; the charts in this report are snapshots. The tables reserve white rows for CSUs. Yellow rows highlight system averages, sector averages without CSU, and other illustrative universities in the sector, Metro and Pueblo in Colorado, Weber State, and Houston Downtown. The data and analysis do not refer to California Maritime Academy because its role, function, and cost are such outliers.

This graph presents an overview of marginal cost at 389 schools in the sector of the CSUs. The values on the red slope range from $5,000 to $25,000. The CSUs fall into three groups, $8,000 to $10,000, $10,500 to $12,500, and above $14,000. The table clarifies details.

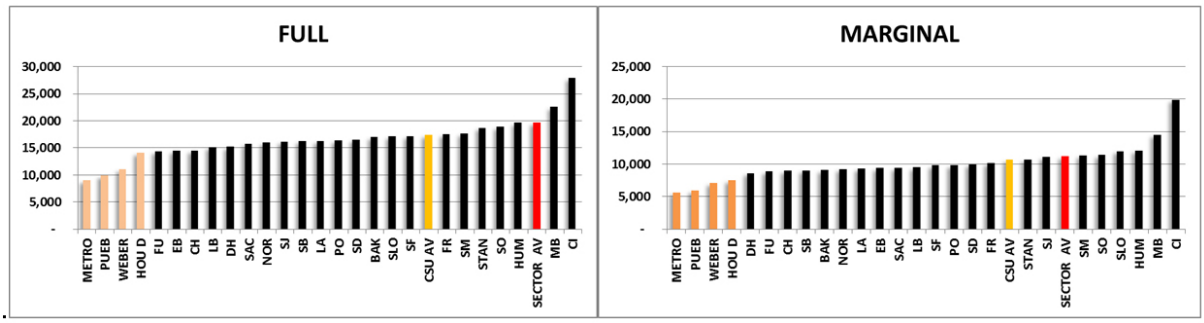


	MARG	FULL	FTES	SFR	INSTR	AC SUP	ST SER	INST	OTH	TTL	BEN	SAL
MET	5,592	9,050	17,321	22	4,142	605	832	919	328	6,843	20%	47,310
PUEB	5,954	9,976	6,679	18	3,905	1,094	1,273	626	596	8,284	22%	45,186
WEB	7,093	11,025	16,009	21	4,672	1,114	1,127	1,501	906	9,576	35%	47,902
HOU D	7,505	14,162	9,330	20	4,427	1,859	587	2,028	3,416	12,813	22%	56,033
DH	8,674	15,244	10,496	26	5,563	1,614	1,874	1,226	2,776	13,064	31%	67,634
FUL	8,926	14,437	27,721	27	6,205	1,144	1,361	1,935	2,166	12,925	35%	64,754
CH	9,023	14,564	15,484	25	5,935	1,707	1,443	1,594	1,514	12,433	37%	61,054
SB	9,076	16,309	14,816	27	6,215	1,237	1,552	1,870	3,390	14,412	35%	59,968
BA	9,112	17,071	7,202	25	5,523	1,658	1,867	1,977	2,258	14,667	34%	61,824
NOR	9,304	16,031	26,787	25	6,146	1,362	2,208	1,411	2,011	13,350	34%	62,233
LA	9,389	16,310	16,718	23	6,346	1,554	1,233	1,982	1,844	13,105	34%	62,674
EB	9,439	14,519	13,395	27	5,831	1,596	2,012	2,000	1,687	13,134	34%	65,753
SAC	9,477	15,813	23,401	26	6,495	1,548	1,575	1,611	2,489	14,047	36%	62,492
LB	9,534	15,215	28,495	24	6,661	1,614	1,626	1,243	1,719	12,942	33%	65,603
SF	9,849	17,255	24,943	25	6,526	1,891	1,412	1,818	2,206	15,944	34%	67,143
PO	9,887	16,441	17,576	27	6,485	1,677	1,876	1,792	2,660	14,564	35%	66,070
SD	10,025	16,610	28,359	26	6,220	1,929	2,585	1,262	2,268	14,564	36%	67,068
FR	10,192	17,588	17,942	24	6,293	2,193	1,876	1,829	3,182	15,713	40%	59,402
CSU AV	10,697	17,387	15,972	24	6,803	1,888	2,105	2,075	2,128	15,416	35%	63,360
STAN	10,730	18,774	6,988	21	6,533	2,232	2,033	2,078	2,442	15,843	35%	59,941
SJ	11,145	16,236	23,310	24	7,698	1,685	2,269	1,556	1,221	14,504	34%	67,200
SECTOR AV	11,242	19,704	8,959	18	7,539	1,804	1,637	2,422	1,843	17,375	35%	53,296
SM	11,391	17,708	7,405	23	6,791	2,334	1,968	2,742	2,297	16,177	35%	63,116
SO	11,427	18,948	7,364	22	6,985	2,176	2,405	2,249	1,369	17,517	35%	61,598
SLO	12,052	17,189	18,225	21	8,256	1,784	2,357	1,932	1,114	15,604	35%	64,353
HUM	12,137	19,677	7,232	22	7,217	2,168	2,585	2,935	2,596	17,562	35%	58,294
MB	14,570	22,598	4,364	24	7,809	2,522	4,134	3,997	2,059	20,676	36%	55,314
CI	19,965	27,984	3,154	19	11,933	3,910	4,054	4,608	1,555	26,398	35%	70,441

The averaged CSU marginal and full cost rates are lower than the rates for the sector as a whole. This is due mainly to the high SFR and the lower cost for Instruction, despite the much higher mean replacement salary in the CSU. Economy of scale - compare the averaged

FTEs - restrains the effect of Institutional Support on marginal cost, too. The next two charts focus on the relative order of marginal and full cost for the universities.

The table exposes the challenges and chances for reducing marginal and full cost. The highlighted data for the peers at the top of the grid show low replacement/entry salaries and benefits. CSU is unlikely to match those; salaries are negotiated, and benefits are set externally. But the effect on cost of Instruction can be achieved, to some degree, in other ways, by increasing SFR and decreasing the proportion of truly full-time faculty. Of course, if these moves yield a graduates/FTES index as low as at Metro State (see full data), then the change is a false saving; it actually increases the cost per graduate.



There is a less draconian but more arduous way to reduce cost. Determine the top third performances in each relevant category; average the costs. Treat each average as a limit-floor or ceiling, as pertinent. Study the campuses that already meet the thresholds. This approach could reduce the average marginal cost by 20%, under $9,000. It also could bring discipline, scale, benchmarks, and purpose to the unruly mob of current cost-saving projects. And for that matter, it could quash the hokum on for-profit efficiency. This chart sums data on 211 such schools that enroll at least 1,000 students.

It is true, however, that the twenty-four for profit universities that are fully online reduce cost substantially. Typically they run SFR over 30, hire few full-time and no tenure-track faculty, pay FTEF in the range of $40,000, and tamp down benefits. On the other hand, they graduate 18% in six years; the CSU rate is 48%. Their degree completion rate (DG/FTES) is 12%; the CSU rate is 27%. Marginal and full costs are as follows:

	Mean		Mean	25 Percentile	75 Percentile
INSTR	1,737	MEAN SAL, BEN/SSFR	2,434	2,918	2,431
		NON-PRSNL EXP IN INSTR	1,477	770	1,684
SUPPORT	5,129	SUPPORT	5,975	3,886	7,882
MARGINAL	6,866	MARGINAL	9,886	7,571	11,995
FULL	9,998	FULL	13,447	7,162	17,054

Large questions remain. Minor and major capital projects were funded out of additional pots. If that is no longer to be, should they be scheduled into full cost like depreciation? To that end, technology infrastructure has never had a stable source. Should it, and should these formulae be it?

Finally, marginal cost data reveal one source of the perception of structural deficits. When the figure-really the purchase price for new permanent enrollment-is lower than current funding per FTES, it smells like fire. Is the lower price sustainable since it, too, seemingly will convert to higher cost long-term? But that is not necessarily so, to the degree feared. The current funding consists of an accretion of system-wide increases on sequences of unevenly achieved local fees and on legacies of state funding that varied by the newness, size, and mode/level of each campus. The flanking table averages four years of such data through '09-10.

CSU	MARGINAL	FUNDING	DELTA
CMA	17,716	24,745	7,029
CI	14,356	18,793	4,437
MB	11,310	15,398	4,088
SM	9,486	12,054	2,567
HUM	10,854	13,068	2,214
SO	10,205	11,928	1,723
EB	9,291	10,963	1,672
SD	9,703	11,183	1,480
DH	9,328	10,591	1,262
FR	9,109	10,316	1,207
BAK	9,708	10,712	1,004
PO	9,773	10,382	608
CH	9,523	10,046	522
NOR	9,488	9,781	292
FUL	9,522	9,739	217
SB	9,407	9,581	174
SAC	10,084	10,206	122
SF	10,373	10,395	21
SLO	11,968	11,971	3
SJ	10,875	10,806	(70)
LA	10,066	9,946	(120)
STAN	10,900	10,340	(559)
LB	10,369	9,373	(996)

The system, though, largely abandoned such pegging under Chancellor Munitz. So, as the campuses age, one should see greater convergence between marginal cost and funding per

FTES on the small/newer campuses. And indeed, one would expect convergence across all campuses.

The meeting and then crossing of these two figures on several old, large CSUs would indicate that funding lagged market pricing disturbingly. This is so because marginal cost is weighted toward the salary of an assistant professor, at once particularly subject to market demands yet the lowest tenure rank. We are entering that stage.

The Practice

As seen in the data above the marginal costs, and its components, vary a great deal across campuses. These costs were derived using a standard formula, and based on data from the IPEDS data base. The practice, however, tells a different story.

Student to Faculty Ratios

The Student to Faculty Ratios SFR reported in IPEDS is an average for the entire undergraduate enrollment, and does not reflect differences in costs for different programs and class levels. In the last four years, the CSU SFR for lower division classes averaged around 31 (see [3]), while upper division classes averaged around 25, and is currently at 27. Variations in enrollment are handled in different ways at the different class levels. In large enrollment lower division classes a decrease/ increase of enrollment will usually be addressed by a mixture of adjusting the SFR and adding/canceling sections. Only the adding or cancelling of classes will cost or save money. The SFR adjustment will be mostly neutral with respect to the costs. The additional cost/saving will happen at the SFR of 31, not at the SFR of 25 as stated in the formula above (for CSUN). The situation at the upper division level is entirely different. In programs with a large number of majors (> 500) multiple sections of upper division classes are offered every semester. A substantial increase/decrease ($> 5\%$) of majors may require adding/canceling sections of such classes. Most programs (and virtually all at small and medium campuses) are smaller than that. In these programs only one section of a required upper division course may be run per semester or even per year. And often these sections are under-enrolled, but have to be offered in order to let students graduate. In these cases, increases or decreases of up 10% will be entirely absorbed by adjustments in the Student to Faculty Ratio.

Replacement Salaries

When adding a class, the common practice is to hire a new lecturer or increase the workload of an existing lecturer. Only after a certain threshold of growth is achieved (usually over multiple years) will tenure track faculty be added. Currently, at CSUN's Mathematics Department, despite an enrollment growth of over 25% over the last 5 years, new tenure track hires are only keeping pace with retirements. The tenure track faculty did not increase, since 2007. So, growth in enrollment will be almost entirely absorbed by hiring lecturers at a salary below $50,000/year. Now if classes are canceled, it will always be at the cost of the lectures with the least seniority and the lowest salary.

Instructional, Academic, and Institutional Support
The actual figures from CSUN's financial report for 2010/11 [2] are markedly lower than the figures from the IPEDS data base. These costs were 1330,1380, and $1411, respectively.

Student Services
The IPEDS data show $2,011 per FTES, excluding the money for State University Grants. However, the 2010/11 CSUN Financial Activities Report shows $2,370 per FTES, including the State University Grants. This amount will be used in the following analysis.

The Estimated Actual Marginal Cost per FTES:
Using a $50,000 salary, and SFR of 31, yields the following costs (after benefits):
Replacement Cost: $2,161
Instructional Support: $1,197
Academic Support: $1,104
Student Services: $1,541
Institutional Support: $847

This yields a marginal cost of $6,850, or roughly $2,500 less than the LAO formula. This number does not take into account the effect of absorbing some of the enrollment changes by adjusting the student to faculty ratio. Assuming that a decrease of enrollment will result a decrease in SFR by one (approx 3%), and an increase will result in an increase of SFR by one, we get different values for the marginal cost/savings for increasing and decreasing enrollments.

For an increase of enrollment at an SFR of 32, one gets a marginal cost of $6,683, whereas the decrease at a SFR of 30 will yield a marginal savings of $6,922.

The $50,000 salary is the reimbursement rate used internally, the actual rate at which lecturers are hired (in Math) is $42,000, or a replacement cost of $1,816!

The Impact on Revenues:
The university earns a net fee revenue (discounts in the form of state university grants are accounted as costs in student services) of approximately $7,000. Based on this the net marginal savings, the university loses $78 per FTES it doesn't accept! The net marginal cost net for increasing enrollment brings in $317 for every new FTES.

But there are other revenues connected with enrollment. These come mostly through auxiliaries. The University Corporation's housing, parking, and health services earned $26 million or $963 per FTES. Assuming the same factor of 65% as in student services in the marginal cost calculation, this additional marginal revenue is $626. In total, the marginal revenue per FTES is $7,626 Comparing this with the marginal cost/saving one comes to the following

numbers:
Net marginal savings for decreasing enrollment per FTES: -$704
Net marginal cost for increasing enrollment per FTES: -$943

In other words, the university earns $943 for every extra FTES, and loses $704 for every FTES of enrollment cuts. Now in growing the enrollment, at some time the University will have to hire full time tenure track faculty at added cost. By contrast in shrinking the enrollment the University will always only "save" at the lowest lecturer salaries! The table below shows the relationship between faculty salaries and SFR for revenue neutral growth. The third column gives the maximal salary for revenue neutral growth with considering auxiliary revenue, found in the last column.

Max replacement w/o auxiliaries	SFR	Max. salary	Max replacement w auxiliaries	Max Salary w auxiliaries
2311	20	34493	2927	43687
2311	21	36217	2927	45871
2311	22	37942	2927	48055
2311	23	39667	2927	50239
2311	24	41392	2927	52423
2311	25	43113	2927	54507
2311	26	44838	2927	56691
2311	27	46563	2927	58875
2311	28	48288	2927	61059
2311	29	50013	2927	63243
2311	30	51738	2927	65427
2311	31	53463	2927	67611
2311	32	55188	2927	69795
2311	33	56913	2927	71979
2311	34	58638	2927	73163
2311	35	60363	2927	75347

The table shows that at the current cost structure the University can afford to add new students at a SFR as low as 28 and a salary of $50,000.

Full-time Hiring:
As the faculty ages, retiree's must be replaced. We must bear in mind that faculty at retirement earns relatively high salaries of around $100,000. These are replaced with new hires at around $75,000. Retiring two faculty members almost pays for three new hires. But since the workload of three faculty is higher than the workload of two, the remaining cost for the three new faculty can be largely covered by the decrease in workload for lecturers. There are some costs such as promotions that are not taken into account here. Since most faculty

members will receive two promotions during their career there are future costs connected with hiring. But in general this strategy will move the age (and as such the income distribution) toward lower numbers and as such will not generate any substantial cost.

Conclusions:

- Increasing enrollment comes at lower than expected cost, and when coupled with an increase in efficiency (higher SFR) can actually stabilize the financial situation of a campus.
- Decreasing enrollment saves less, if any money and will almost always have the side effect of reducing the efficiency of a campus (lower SFR, lower utilization of existing infrastructure). The exception to this rule is, if enrollment is decreased by closing inefficient programs or even entire campuses.
- Many of the smaller campuses are very inefficient, and should grow enrollments to a sustainable level of efficiency.
- Large Campuses should use an enrollment target that optimizes efficiencies.
- Surpluses from auxiliaries should be used to subsidize instruction and other areas related to the core mission of the university.
- Specialty campuses (such as SLO, and CMA) and destination campuses (such as Humboldt, where the overwhelming majority of students do not come from the immediate area, but rather from the urban Bay Area and Southern California) should consider substantially higher fees.

References:

1. IPEDS: The Integrated Postsecondary Education Data System, National Center for Education Statistics, http://nces.ed.gov/ipeds/
2. CSUN Financial Statements 2011, http://www-admn.csun.edu/financials/docs/fin-statements-2011.pdf
3. CSUN Office of Institutional Research, http://www.csun.edu/ instrsch/