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David Yamoah

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Author(s): David Yamoah

INTRODUCTION

A variety of tax reform initiatives have impacted on the ability of New Jersey and some states in the United States to fund public higher education. Public Higher Education faces competition for limited state resources from a variety of state mandatory spending measures including health, criminal justice and elementary and secondary education. In addition, concern about the cost of higher education has resulted in demand for accountability in the use of public funds, which has lead to the need to establish relationship between funding and cost of providing higher education.

Funding for most public higher education breaks down into two major parts, the Enrollment-based support and the Performance or Incentive-based support (Burke and Sedan, 1997). The Enrollment-based support is an enrollment-driven funds received and/or generated by the institutions. Enrollment-driven support includes State Instructional subsidy and Student Tuition. In New Jersey the State Instructional subsidy could be classified as quasi-enrollment based since it has traditionally been based on enrollment levels. The Incentive-based support is a state initiative to provide funding for specific programs or projects, and this funding process ties funding for higher education to performance. For most New Jersey public institutions about 75% of the institutional funding is in the form of the so-called Enrollment-based support, about 15%, is Performance or Incentive -based support, while the remaining 10% is generated from endowment income, alumni giving and other non-traditional sources. This paper examines the Enrollment-driven support, and attempts to establish a relationship between enrollment-based receipts and costs.

Background for Enrollment-Based Costs and Revenues

Enrollment-Driven Cost: Instructional Subsidy

State Instructional subsidy for NJ Higher Education institutions has traditionally been determined through an enrollment-driven cost formula. Prior to 1986 the state funding was determined on the basis of student enrollment level, institutional mission and programs. Since then the State funding or the subsidy has remained fairly steady except with slight variations due mostly to inflation and adjustment by the State. The subsidy is intended to offset costs of higher education that otherwise would have been borne by students, thereby making higher education affordable and accessible. The State subsidy possess a number of concerns to the academic institutions include funding equity, stability, and predictability.

The enrollment-driven cost formula for New Jersey’s institutions has been on the bases of known

differences in program structure and activity, e.g. institutional mission, program level, and program differentiations. The funding formula attempts to provide equitable distribution of funding among New Jerseys higher education institutions. However, some institutions are constrained by their mission and program level to commit additional resources to provide developmental and other support programs, particularly to disadvantaged students. Such programs invariably do not attract additional state subsidy but rather would require the institution to fund such program from its own resources.

Even though the state subsidy appears to be steady from period to period far too often the State has had to make midyear budget amendment particularly when an institution's actual enrollment level falls short of target enrollment level. On the other hand if an institution's enrollment exceeds target level that does not necessarily attract additional state funding. Such funding process puts undue pressure on institutions that end up with fewer enrollments below the target levels, and already face budget short falls.

Enrollment-Driven Revenue: Tuition

Student tuition and fees is Enrollment-based revenue generated by the institution. The size of the tuition for students enrolled in higher education institutions in NJ depends on institutional budget and the state instructional subsidy. The rising institutional operating costs and the dwindling state appropriations for institutional support have been the main cause of rising student tuition and fees. Tuition and fees have, thus, become a user-tax on households investing in higher education.

Tuition revenues are generated from 8 groups of students:

1. Full-Time: a) Undergraduate-Resident, b) Undergraduate-Non-Resident; c) Graduate-Resident, and d) Graduate-Resident/Non- Resident; and

2. Part-Time: a) Undergraduate-Resident, b) Undergraduate-Non-Resident; c) Graduate-Resident, and d) Non-Resident.

The dominant group in both the Full-Time and the Part-Time student population is the Resident-Undergraduate student body that represents about 90% of the entire student body.

Methodology

Utility Function for an Academic Institution.

The Newhouse (1970) utility model for non-profit institutions is employed to develop a utility function for the academic institution. The utility function is assumed to be made up of quality (q_0), and quantity (q_1) i.e. $U=f(q_0,q_1)$. Quality reflects the professional standing, size and prestige of the institution. Quality also determines the stature and compensation of administration and faculty. Quantity on the other hand reflects the number of student body enrolled in the academic institution. In this model quality is assumed constant or given on the basis of minimal permissible level of accreditation. Thus, for a given quality an academic institution would maximize its utility function based on quantity and subject to budgetary constraint. The utility function thus becomes a single variable function, i.e. a function of quantity, with a downward sloping demand curve where by the Total Revenue equals Total Cost, TR=TC

In maximizing its utility an academic institution would equate Average Revenue with the Average Total Cost in the course of its normal operations. This arrangement will permit the institution the opportunity to offset the average operating costs with average revenues. Thus, the AR=AC process could be used to establish average class size for the academic institution.

Model for Tuition Revenues and Instructional Costs

Tuition.

Let us suppose that the State Instructional subsidy is given by $S, this is a fixed subsidy provided by the state based on an institution’s enrollment levels, programs and mission.

Also, let the number of student credit-hours per year be equal to H, and cost per credit be $c. Then total student tuition revenue will be given by $cH. We also let $G to represent the Incentive funding (federal and state grants). In addition, we let $E be other institutional sources of revenues, including endowment income, alumni contributions and non-traditional receipts. The total Institutional Funding will then be given by:

$S + G + E + cH$.

Expenses .

Operating costs, on the other hand, focus on expenditure requirements for such areas as academic instruction, student services, maintenance and operations, and institutional support.

We let expenses for student services, maintenance and operations, and institutional support amount to = $F, this is considered a fixed amount. Also, let there be N number of course sections per year, and let $C be the average cost per faculty per class section. Then, the annual class instructional costs will be given as $NC. Hence, total institutional expenses would be given by:

$F + NC$

In a value maximization environment (i.e. zero profit) average receipts should equal to average expenses, i.e,

$$S + G + E + cH = F + NC$$

In the above equation we argue that S, the State subsidy is predetermined; G, government grants are awarded on basis of programs; and E, endowment income, alumni giving and other non-traditional revenues, is relatively small. Similarly, F represents the overhead (operational and institutional costs), which is assumed fixed. Therefore, S, G, E, and F are assumed constant and are given by A (i.e. $A= F-S+G+E$). The two remaining variables are student tuition, cH, and instructional costs, NC. Since the major component of instructional costs is faculty compensation and benefits, which is union negotiated, it is safe to say that Instructional Costs is an independent variable, and that the Tuition Revenues will be the dependent variable. Thus, we can write:

Equation 1: $cH = A + \alpha NC$

Here we have enrollment driven revenues in the form of Tuition fees, and enrollment-driven costs in the form of Instructional cost. The above equation thus shows a direct relationship between enrollment levels and instructional costs.

It is generally true that faculty cost, C is about the same for small classes as well as large classes and as such additional support may not be needed for large classes. Furthermore, the number of class sections offered may not impact on the State subsidy but could have some implications for institutional costs. Hence, for effective and efficient utilization of resources enrollment levels should relate to class size and number of sections.

We let Tuition Revenues be given by T, and Instructional Costs be I (I= NC), or we can write:

Equation 2 $T = A + \alpha I$

This provides a linear equation which relates tuitions revenues to Instructional Costs, and provides an input-output relationship.

Data and Model testing

A linear regression model developed for NJPHE (Equation 1) was tested empirically using data obtained from both the NJ State Department. Annual data was obtained for 12 NJPHE institutions covering a 16 ten-year period from FY1989 to FY2004.

The hypothesis is that Instructional Costs is a good predictor of the student tuition. In addition, the model can be used to determine the elasticity of tuition increases due to Instructional cost. Upon examination of the data one of the institutions was dropped from the group (Thomas Edison College) due to lack of sufficient data on Instructional Costs. Thomas Edison College has virtually no instruction costs.

Results and Conclusion

A Ordinary Least Squares (GLS) estimation technique was used in the time-series regression analysis for all the institutions as a group over the 16-year period from 1989 to 2004. Table A provides a summary the results for the entire NJPHE institutions as a group. The beta estimate determines the rate at which Tuition increases in relation to Instructional Costs. The analysis shows that there is a strong relationship between the Tuition Revenues and Instructional Costs among the NJHPE with a beta estimate of 1.019, and an R-Square of .961. The t statistics (t= 18.456) was very significant at 95% confidence interval. The test results suggest that, on average among the NJPHE institutions, a dollar increase in instructional cost will lead to about 110% proportionate increase in Tuition.

Ordinary Least Squares (OLS) estimation technique was also used in the regression analysis for the individual institutions. The goal of the test is to determine the marginal propensity to increase Tuition following an increase in Instructional Costs for each institution. The test results for the 11 NJPHE institutions are summarized in Table B. The results indicate that the 11 institutions show strong correlation between Tuition Revenues and Instructional Costs with R-Squares of between .73 and .97. The beta estimates for the 11 institutions are very significant at 95% confidence interval. According to the beta estimates the marginal rate of Tuition Revenues increase due to Instructional Cost range from a low of 0.457 for University of Medicine & Dentistry to 1.815 for the College of New Jersey.

It appears that state budget allocations that do not match institutional expenditures, particularly instructional costs, have compelled New Jersey higher educational institutions to gradually increase tuition and fees to New Jersey residents. The University of Medicine and Dentistry, which receives most of its funding from the state has the lowest marginal propensity to increase tuition of about 0.457. On the other end the College of New Jersey has the highest propensity to increase tuition of about 1.815. With the exception of UMD, Rutgers and Stockton a dollar increase in instructional cost leads to more than a dollar increase in tuition

Table A Model: Tuition Revenues = Intercept + Beta (Instruction Costs)

INSTITUTION	BETA	R-Square	DURBIN-WATSON
New Jersey Public Higher Education	1.019 (0.055) t=18.456*	0.961	1.584

Table BModel: Tuition Revenues = Intercept + Beta (Instruction Costs)

INSTITUTION	BETA	R-Square	DW
College of New Jersey	1.815 (0.168) t: 10.807*	0.893	1.241
KEAN University	1.157 (0.164) t: 7.069	0.781	1.070
Montclair State	1.610 (0.090 t=17.825*	0.958	1.951
New Jersey City State University	1.660 (0.268	0.733	1.504

	t=6.205*		
New Jersey Institute of Technology	1.424 (0.124) t=11.444*	0.903	1.748
Ramapo College	1.189 (0.079) t=15.059*	0.942	2.091
Rowan University	1.121 (0.113) t=9.953*	0.876	1.298
Rutgers University	0.828 (0.041 t=20.340*	0.967	1.606
Stockton State College	0.924 (0.105) t=8.808*	0.847	1.102
University of & Medicine Dentistry	0.457 (0.034) t=13.306*	0.927	0.667
William Paterson University	1.431 (0.068 t=21.058*	0.969	1.611

Number of observations for each Institution = 16

* Significant at the 0.05 level

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