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URBAN HIGHER EDUCATION ENROLLMENT DEMAND*

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Introduction

A number of recent studies have estimated demand functions for higher education enrollment. These studies have confirmed the general hypothesis that a large portion of enrollment demand variance is accounted for by factors traditionally included as arguments in the demand function. For example in their pioneering work in this area, Campbell and Siegel [2], using aggregate United States time series data, explained 80 percent of the variation in the ratio of enrollment to potential enrollment with two variables: the relative price of education to other goods; and real household income. Moreover, each of these variables had the anticipated direction of effect, and regression coefficients were statistically significant. Other time-series and cross-sectional endeavors [4, 5, 6, 8] have reaffirmed these results and have extended the analysis to include such factors as the price of substitutes, proximity of students to institutions of higher learning, the level of the armed forces, and a set of variables reflecting various benefits and costs potential enrollees perceive from pursuing higher education. These studies have concentrated on two specific markets: the aggregate national higher education market; and the cross-sectional market for large private and public universities. However, a review of the literature in this area indicates that no such demand function exists for a particular urban university or urban area.¹ It is the purpose of this study to estimate an enrollment demand function for a regional campus in the Indiana University system -- namely, the regional campus at South Bend. This campus has approximately 6,000 students, is non-residential, and is located in an economic region of 500,000 with per capita income approximately the same as per capita income for the United States.

*I would like to thank R. Pfister, K. Turner and two anonymous reviewers for useful comments they have provided. I would also like to thank Indiana University at South Bend for financial support given me to undertake this research.

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¹A thorough review of the literature did not reveal any higher education enrollment demand estimates for an individual urban campus. The interests of researchers in this field appears to be confined to the aggregate time series market, or the cross-sectional state market, or the difference between public and private institutions. It is quite possible that in-house studies have been performed on higher education enrollment for internal use by various regional campuses and consequently would not be found in the normal review of the literature. However, in the experience of the author, these in-house enrollment projections are generally based on demographic rather than economic factors.

The absence of regional or urban demand function estimates raises questions with regard to the predictive validity of these previous endeavors. This is the case because most future higher education enrollment growth is, at least within state supported systems, anticipated to take place on the urban regional campuses, and because students at the urban campuses differ quite markedly from their main campus and private school counterparts in terms of socio-economic attributes. For instance, in the case of regional campus students in the Indiana University system as compared to main campus students, regional campus students tend to be older, come from relatively lower income households, are more likely to work full or part time while pursuing their educations, are more likely to be married, and rely on themselves for a larger portion of their educational financial support.² Thus these differences in attributes suggest the possibility that regional campus students might behave quite differently in response to various economic stimuli vis-a-vis students previously analyzed in more highly aggregated markets. The results of this study are intended to determine whether the aggregate model of higher education enrollment demand is a valid representation of student behavior at the micro level of the regional campus market.

Model of Enrollment Demand

Following recent work in the area of enrollment demand, we treat the decision to enroll in an institution of higher education as a market phenomena reflecting both consumption and investment motives. The potential enrollee chooses the single most appealing education alternative -- regional campus enrollment, public residential campus enrollment, private college enrollment, or non-enrollment -- based on his evaluation of their relative benefits and costs and given the constraints placed on him in terms of income available to him for his education, as well as his educational ability, as measured by those screening applicants for various institutions. The general functional form of this enrollment demand function is given as:

$$N/E = F(P_o, P_s, I, OC, QL)$$

$$\partial F/\partial P_o < 0; \quad \partial F/\partial P_s > 0; \quad \partial F/\partial I > 0;$$

$$\partial F/\partial OC < 0; \quad \partial F/\partial QL > 0.$$

where the ratio of enrollment (N) to potential enrollment (E) in a given market is a function of its own price (P_o), the price of substitutes (P_s), real household income (I), other costs of enrollment (OC), and an index of educational quality (QL). The anticipated direction of impact of each of the variables on N/E is given by the partial derivatives. Inasmuch as we are attempting to estimate a structural demand function, it is necessary for purpose of identification to place restrictions on the market supply curve for this service. The usual assumption, and the one we follow here, is that during each of the time periods tuition

²These comparisons are based on Indiana University registration data and data presented in a report documenting per student differences in state support between regional campuses and the main campus [11].

(P_0) is held to be a predetermined variable, or equivalently supply is infinitely elastic with respect to tuition during any given time period.

At the regional campus level, the market approach suggests that the potential regional campus enrollee bases his decision on:

- (a) Regional campus tuition (T_{reg}); tuition at private institutions in close proximity (T_{priv}), and tuition at residential colleges (T_{res}); T_{reg} expected to bear negatively on enrollment; T_{priv} and T_{res} expected to bear positively on regional campus enrollment;
- (b) Costs of room and board at a residential campus (RMBD); expected to bear positively on regional campus enrollment;
- (c) Real household income (I); expected to bear positively on regional campus enrollment;
- (d) Labor opportunities open to the potential enrollee which we measure by unemployment rates lagged one and two months prior to the semester of enrollment (U_{-1} and U_{-2}); expected to bear positively on regional campus enrollment;
- (e) The impact of the draft on providing an incentive to the student to enroll to gain draft deferments prior to the lottery plan and volunteer armed forces; measured by a dummy variable which is 0 for all years prior to the lottery and 1 starting with the lottery and thereafter; expected to have a negative bearing on regional campus enrollment;³
- (f) Benefits the potential enrollee perceives from attending the regional campus, these benefits being of two types: (1) the life-time income benefits -- specifically, the absolute difference between average annual income of college and high school graduates for which we have no measure for the South Bend SMSA and (2) indices of course offerings -- lower level courses (LOCOR); upper level courses (UPCOR); and graduate level course (GRCOR); all course offering indices are expected to bear positively on enrollment.

Inclusion of indices reflecting course offerings as explanatory variables needs some justification. The rationale behind inclusion of these variables stems from two sources: (1) the use in other work of a variable reflecting cross-sectional quality differences in higher education [2, 8, 10] and the

³While a major contribution of the Galper and Dunn work [5] is the inclusion of a variable reflecting the size of the armed forces, their study ends with the 1964-65 academic year, thereby not including the Viet Nam war period and the subsequent changes that have transpired in selective service laws.

tremendous change in the program offered at the regional campus under study. There is no doubt that part of the enrollment demand change during the past 13 years has been due to the transformation of what began as an extension -- with predominantly part time faculty and offering no degrees of its own -- to a regional campus having a majority of courses taught by full time faculty and offering numerous undergraduate degrees. For instance, in 1963 approximately 90 percent of the courses were taught by part time faculty. In that year, the extension offered no degrees of its own, offered 52 lower level courses, 34 upper level courses and 8 graduate courses. Contrast this to the fall semester of 1974 where the majority of courses are taught by full time faculty, a full menu of degrees is offered in arts and letters, business and education; and where 167 lower level courses, 209 upper level courses and 68 graduate courses were offered. The inclusion of these course offerings indices, albeit an imperfect measure, is an attempt to capture the dramatic changes in the product being sold at the regional campus during the study period.⁴

Using the above set of explanatory variables, regional campus enrollment demand functions are estimated for semester data covering the period 1963-1974 by regressing the ratio of Indiana University at South Bend enrollment (N) to eligible enrollees (E) against the set of explanatory regressors.⁵ Eligible enrollees are defined as the total number of high school diplomas granted by all private and public secondary schools located within the economic region containing the South Bend campus during the four academic years immediately preceding the fall semester in each of the study years. We recognize that there is some loss of accuracy from using this eligible enrollee measurement for a regional campus such as that at South Bend since some part of that campus's

⁴Although it is possible in this study to use public expenditures per enrollee as a quality variable, it is somewhat doubtful that students in formulating enrollment decisions are conscious of these expenditures as a quality indicator. Moreover because a portion of the expenditures goes towards sinking funds for new capital facilities and for administrative salaries, this variable is a poor indicator of the quality of educational services on a semester by semester basis. Thus course offering indices are used as the only available proxy for educational quality.

⁵While it would be desirable to run regressions for individual semesters, such as the fall semester, for instance, the small number of observations, twelve, makes this impossible given the number of explanatory variables which is eleven. However, some indirect evidence suggests that the factors included in the model influence spring and summer enrollment in much the same way as they do fall enrollment. Consider the situation where only fall enrollment is influenced by the set of regressors used in the study, with spring and summer enrollment a function of other omitted factors. In that case, two-thirds of the observations would have no relationship to the set of explanatory variables and one would anticipate low adjusted R^2 s. In fact, the adjusted R^2 s are reasonably high, .75 or better. This implies that the set of regressors is an important explanatory factor of not only variations in fall enrollment demand, but also variations in spring and summer enrollment demands.

enrollment comes from individuals who are far past the high school graduation age. Unfortunately, there is no way to measure this expanded enrollee set. However, the fact that the population in the economic region containing the South Bend campus has not changed very much during the twelve year study period implies that the total number of eligible enrollees is misstated by approximately the same amount in each time period and in all likelihood has little or no impact on the estimates obtained.⁶

Before presenting our statistical results, a few comments on the data are in order. Our basic series is semester data covering the period fall 1963 to spring 1975. The enrollment data were obtained from the registrar at Indiana University at South Bend. Tuition and room and board figures for the regional campus at South Bend, the residential campus at Bloomington and the private university, which in this case is Notre Dame, are found in bulletins of those institutions covering the years of the study. These figures were deflated using the consumer price index base year 1967. High school graduate data were gathered from statistical information reports of the Office of the State Superintendent of Education in Indiana covering the years 1960 through 1974. Income is an index of real disposable income per household for the South Bend SMSA, using the consumer price index as a deflator and is expressed in terms of the base year 1967. SMSA income data are reported in the Survey of Current Business for selected years. Missing years were obtained by estimating the relationship between Indiana income and South Bend SMSA income.⁷ Unpublished draft information was kindly provided to us by the Selective Service System Indiana State Headquarters. Finally, course offering indices were computed from semester listings of courses for each semester in the period 1963 to 1974.

Regression Results

A number of regression equations were run using different subsets of explanatory variables and different functional forms. In general, the log-linear functional form appears to perform the best from the viewpoint of R^2 values and Durbin-Watson tests. The most informative results are provided by the following estimated equation. Other results are presented in Table 1.⁸

⁶Attempts were made at estimating the potential older population for enrollment by utilizing national or state averages of percentage of college enrollees in specific age-groups. Unfortunately, these attempts failed. The problem here is obtaining a time series for these percentages which can then be transformed to a semester basis for the 1963 to 1974 time frame.

⁷A relationship estimated for the period 1950 to 1972 between South Bend SMSA per household income (Y) and Indiana per household income is given as:

$$Y = -\$357. + 1.0803 (\text{Indiana household income}); R^2 = 0.993$$

Three years of missing data were estimated from this equation: 1963, 1973 and 1974.

⁸Footnote on following page.

TABLE 1: Regression Results*

	17.33	11.93	22.42	18.77	12.70	24.92
F						
\bar{R}^2	.856	.765	.869	.86	.743	.85
lnT _{reg}	-1.6592 (.6661)	-1.6790 (.4521)	-1.602 (.5812)	-1.1949 (.4897)	-1.544 (.4499)	-1.2168 (.4135)
lnT _{res}	.2808 (.2734)	.3577 (.2525)	.2180 (.2340)			
lnT _{priv}	- .4134 (.3650)	- .0324 (.4570)	- .2839 (.2399)	- .3009 (.3486)	.1408 (.4481)	- .3025 (.2385)
lnRMBD	1.0241 (.3775)	.5668 (.3636)	1.0645 (.3505)	.8413 (.3333)	.4877 (.3658)	.8457 (.2523)
lnI	.9516 (.4701)	.8986 (.5678)	.7849 (.2913)	.8383 (.3869)	1.0372 (.5694)	.8571 (.2805)
lnU ₋₁	.0737 (.1932)	- .1731 (.2361)	.0078 (.1820)	.1349 (.1827)	- .1065 (.2355)	.1322 (.1722)
lnU ₋₂	.2088 (.1695)	.3123 (.2212)	.2038 (.1610)	.1757 (.1666)	.2424 (.2196)	.1727 (.1572)
lnLOCOR	- .9111 (.3204)		- .8612 (.2639)	- .7422 (.2753)		- .7539 (.2376)
lnUPCOR	.6689 (.1837)		.6799 (.1679)	.6871 (.1831)		.6818 (.1675)
lnGRCOR	- .0624 (.0941)		- .0709 (.8822)	- .0352 (.0903)		- .0362 (.0801)
Draft	- .0182 (.1662)	.1618 (.1681)		- .0167 (.1663)	.0353 (.1001)	
SUMSEM	- .1196 (.2935)	- .1239 (.2829)		.0148 (.2629)	- .0996 (.2865)	
Constant	-8.8552	-8.800	-8.3919		-9.785	-8.79531
D.W.	1.914	1.421	1.893	1.8523	1.2099	1.8422

* Dependent Variable in all equations is ln(N/E)

$$\ln(N/E) = -1.6592 \ln T_{reg} + .2808 \ln T_{res} - .4134 \ln T_{priv} + 1.0241 \ln RMBD$$

(.6661)	(.2734)	(.3650)	(.3775)
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$$+ .9516 \ln I + .0737 \ln U_{-1} + .2088 \ln U_{-2} - .9111 \ln LOCOR$$

(.4701)	(.1932)	(.1695)	(.3204)
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$$+ .6689 \ln UPCOR - .06246 \ln GRCOR - .0182 \text{ Draft} - .1196 \text{SUMSEM} - 8.$$

(.1837)	(.0941)	(.1662)	(.2935)
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$$\bar{R}^2 = .856 \qquad \text{D.W.} = 1.914 \qquad () = \text{Standard Errors}$$

Demand for regional campus enrollment appears to be significantly influenced by four factors: (1) regional campus tuition; (2) room and board costs at an in-state residential campus; (3) household real income; and (4) regional campus course offerings.⁹ Tuition at Notre Dame (T_{priv}), a private institution in close

⁸As far as it can be ascertained, the literature on higher education enrollment demand has ignored the possibility that simultaneous effects might exist between dependent and independent variables. In considering the variables included in the demand function, the only apparent possibilities for such simultaneity are the course indices. However, results run without these variables (see the second and fifth equations of Table 1) indicated there were no significant changes in the coefficients of other variables when these indices were omitted. This implies that simultaneity problems are probably of little importance to the major conclusions arrived at in this study.

⁹Although we had expected the signs on all the course indices to be positive, the sign on the lower level course index turns out to be negative in all of the regressions runs. Because the course offering indices have a simple correlation of .72, the incorrect sign might be explained by multicollinearity. Regression equations were reestimated dropping out one of the course indices. The sign pattern did not change under this procedure. Moreover, both indices remained statistically significant ($\ln LOCOR$ by itself as a regression coefficient of -.367 and standard error of .125; $\ln UPCOR$ by itself as a regression coefficient of .363 and standard error of .118). Thus multicollinearity does not provide an answer to the unanticipated sign pattern. It appears that this sign pattern is explainable by two peculiarities of the budgetary process in the Indiana University system -- namely (1) that summer sessions in the Indiana University system are not supported by tax revenues and hence must pay their own way; and (2) that the amount of state subsidy to its universities is based on fall enrollment. This means that course offerings are not only reduced in the summer session but also are skewed towards lower level courses having large enrollments and easily paying their own way. As evidence, consider the average ratios of lower (freshmen plus sophomore) to upper (junior plus senior) level courses during the study period: fall semester 1.35; spring semester 1.20 and summer semester 1.90. Thus, a much lower total course offering skewed more heavily in the summer towards lower level courses in all likelihood explains the negative relationship between the dependent variable and the number of lower level course offerings.

proximity to the regional campus under consideration, appears to have little or no influence on regional campus enrollment, this variable not being significant in any of the regression equations that were estimated. Much higher tuition costs at Notre Dame -- \$69 per hour average over the study period vs. \$17 per hour average during the same period for Indiana University at South Bend -- probably indicates that Notre Dame is not a relevant substitute for IUSB students. Finally, none of the opportunity cost variables (U-1, U-2, Draft, SUMSEM) are statistically significant.¹⁰ This result is consistent with findings of other studies where these same opportunity cost variables have been included.¹¹ These variables nonetheless have the anticipated direction of impact on N/E.

Because we are attempting to assess the validity of the higher education enrollment demand model as it explains behavior in a single urban market, we consider the conformity of our results to results obtained in other studies. These comparisons are presented in Table 2. They show that the income and substitute price elasticities estimated in this study are very similar to results derived in other works -- our income elasticities falling in a range of 0.8849 to 1.0372 and our substitute price elasticities falling in a range of 0.2808 to 0.3577, while the similar elasticities in other studies are in the range of 0.6917 to 1.2036 and 0.1944 to 0.2427, respectively. The major difference in these results is the much higher (absolute) value of the own price elasticity we estimate in this study.

In interpreting this difference, traditional explanations pertaining to differences in the magnitude of price elasticities appear to apply. These explanations are based on two factors: (1) the availability of substitutes; and (2) the importance of the commodity as part of the budget. In the case of substitutes, the regional campus market has many more substitutes than the more aggregate higher education market. Thus, just as we would anticipate the demand for a single firm to be more elastic than the comparable demand for an entire industry, we would likewise anticipate the single regional campus demand to be more sensitive to changes in price than the entire market demand for educational

¹⁰In addition to the zero-one variable used to reflect selective service law changes, we also used monthly draft calls for the state of Indiana to reflect draft changes. The results presented in Table 1 were not substantially changed by the inclusion of this alternative draft measure. It has also been suggested to the author that the short lag structure for unemployment rates might be the culprit leading to statistically insignificant results. To test this hypothesis, longer lags were used. Specifically equation (1) was reestimated with unemployment rates lagged one and two quarters prior to each semester. The regression coefficient on the natural log of unemployment rates lagged one quarter is -.0077 with a standard error of .0875. For a two quarter lag, the comparable values are -.0052 and .061. These regression coefficients for the natural logs of unemployment rates lagged one and two quarters are of the wrong sign and are far from being statistically significant.

¹¹Various measures of foregone earnings (generally wage and unemployment rates) have been tried without success in [3, 4, 8].

TABLE 2: Price and Income Elasticities from Enrollment Demand Studies

<u>Study</u>	<u>Own Price</u>	<u>Substitutes</u>	<u>Real Income</u>	<u>Comments</u>
Campbell and Segel	-.4404	-	+1.2036	Aggregate U.S. enrollment 1927-1963
Galper and Dunn	-	-	+ .6917	Aggregate U.S. enrollment 1919-1964
Hopkins*	-.2907	+ .2427	N.A.	Public Inst. Cross Sectional State Data 1963
Hopkins*	-.7627	+ .1944	N.A.	Private Inst. Cross Sectional State Data 1963
Hopkins*	-.2524	-	N.A.	All enrollment Cross Sectional State Data
Results Table 1	-1.1949 low -1.6790 high	+ .2808 low + .3577 high	+ .7849 low +1.0372 high	IUSB Semester Data 1963-1974

* These elasticities are computed from data in Hopkins' study. All elasticities are computed at means of the variables. It was not possible to compute income elasticities for this study in that the income variable used by Hopkins is percentage of families with income greater than \$10,000.

services. When we consider the budget importance of tuition, we find that tuition is also a more important part of the budget for the regional campus student or his family than for students or families analyzed in other markets. This is the case, since as noted previously, regional campus students come from relatively less affluent households and finance a larger part of their educational costs from their own sources of funds. Given that elasticities increase with the importance of the item to the budget, we would again anticipate for this reason a higher own price elasticity at the regional campus level of analysis.

Finally, let us consider the role of the regional campus in expanding the demand for higher education services. Several of our regressions show an elasticity for RMBD of about +1. During the study period room and board costs at the Indiana University main campus rose on the average of 5.2 percent a year, indicating that room and board costs had a significant positive impact on IUSB enrollment during this period. Thus, while Hopkins has shown that proximity is not an important factor in higher education demand and argues that the influence of regional campus proximity on enrollment is slight, the results of this study suggest another important role of the regional campus, namely, that it reduces the room and board costs for relatively less affluent students and therefore makes it possible for some who otherwise could not attend an institution of higher learning to earn a college degree [8, pp. 59-60].

Conclusions and Implications

To the extent that the results of this study can be generalized to other regional urban campuses, they have three implications.¹² First, the regional campus higher education market appears to react to economic stimuli in much the same way as aggregate higher education markets, or markets for large residential campuses.¹³ In fact, probably owing to their lower levels of affluence, regional campus students appear much more sensitive to tuition changes than their counterparts in these other markets. Second, the results of this study suggest that one important means by which regional campuses expand the demand for higher education is through reduction in room and board

¹²There are no readily apparent reasons to suspect that these results cannot be generalized to other regional campuses, since students at these campuses are probably not all that different in socio-economic attributes from those at the regional campus analyzed in this study. However, as was brought out in the discussant's comments and discussion following presentation of this paper at the MCRSA meetings, the relationship between regional and main campus demands may differ widely amongst state supported institutions because of relative differences in what these campuses offer students. In effect, factors other than differences in tuition and room and board costs may play a much more significant role in determining the distribution of students between the regional and main campus at some state supported universities as contrasted with others.

¹³Footnote on the following page.

costs below what these would otherwise be if the student attended a residential campus. This implies a somewhat different role of the regional campus than that considered in previous studies, which have attempted without success, to confirm the hypothesis that proximity of student to campus was the major benefit of a regional campus system. And finally, the relatively higher price elasticity of demand for the regional campus implies that any future changes in higher education financing which attempt to place a larger part of the financing burden on tuition vis-a-vis per student state subsidy will have a much more detrimental impact on the regional campus systems than on the main campuses of state supported institutions.

¹³As noted by the discussant of this paper at the MCRSA meetings, there may be some gains to disaggregating the data even further and considering the different categories of regional campus students (i.e., single students, married students, part-time students, full-time students, etc.). It would appear on an a priori basis that these gains will be small. This is so because we have already demonstrated that behavior in response to economic stimuli is very much the same at the highly disaggregated level of the single regional campus as it is for the entire higher education market. This suggests that further disaggregation will probably lead to little new information. Moreover, even if we admit to the possibility that differences amongst students in socio-economic attributes may have some import to their demand behavior, it is very unlikely we would capture these in a time-series approach covering the relatively short period we have for this study.

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