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Vinod B. Agarwal
Old Dominion University, VAGARWAL@ODU.EDU

Donald R. Winkler

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Foreign Demand for United States Higher Education: A Study of Developing Countries in the Eastern Hemisphere*

Vinod B. Agarwal
Old Dominion University

Donald R. Winkler
University of Southern California

I. Introduction

Foreign student enrollments in the United States have increased rapidly over the past 25 years. The total number increased from 36,494 in 1954 to 336,990 in 1982. While foreign students still represent less than 2% of all higher education enrollments in the United States, this proportion is likely to grow over the next decade as enrollments of American citizens decline. One consequence of the growth to date has been that many colleges and universities depend on foreign students for an important part of their tuition revenue or enrollment-determined budget, and this dependence is also likely to grow over the next decade. Another important consequence of larger flows of foreign students is an increase in immigration to the United States of skilled labor as students adjust their visa status to immigrant.

The growing influence of foreign students as consumers of U.S. higher education services underscores the importance of better understanding the nature of this phenomenon. This paper sets forth a model of foreign demand for U.S. higher education and estimates that model for several countries using time-series data for 1954–73. The only countries selected for study are low- or middle-income Eastern Hemisphere nations. These countries were chosen in part because they had the highest rates of enrollment growth in the United States. In addition, these countries were treated similarly by U.S. immigration legislation and were treated differently from Western Hemisphere and Western European countries.

In what follows, the theory of student demand for U.S. higher

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education is presented. Next, the model is specified and the estimation procedure explained. Then the data and some of its problems are discussed in detail. Last, the estimated demand equations are presented, the results discussed, and the policy implications evaluated.

II. Theory of Student Demand

The theory of human capital provides a methodological framework within which to analyze foreign student flows to the United States. This theory, of course, also underlies the demand by U.S. students for higher education and has provided the justification for student demand models in several empirical studies.[1] As will be discussed shortly, the foreign student's deliberation on attending a U.S. institution of higher education varies in some important respects from the decision of the domestic student.

Briefly stated, the theory of human capital implies any individual will invest in higher education until the rate of return on the last unit of higher education is equal to the rate of interest, which is the cost of borrowing the investment funds in a perfect capital market. The rate of return is calculated from the perceived or expected costs and benefits of the investment. The theory implies that the individual attaches a monetary value to current and future nonpecuniary consumption benefits in his computation of the rate of return. Once the student has decided to invest, he may select a particular college or university utilizing a similar computational framework. The student will select the institution yielding the highest rate of return if that return exceeds the rate of interest.

The theory thus implies that demand for higher education varies directly with the rate of return and inversely with the market rate of interest. The well-known imperfections in the capital market, however, render the interest rate a relatively unimportant factor while making family income and financial aid important variables affecting demand. Demand is thus expected to vary directly with expected income differentials attributable to higher education, family income, and financial aid and inversely with tuition, books and supply expenses, and opportunity costs. Studies of demand for higher education in the United States have attempted to estimate the elasticity of demand with respect to these independent variables.[2]

The prospective foreign student deliberating whether or not to study in the United States can be assumed to have already determined that the rate of return on an undergraduate or postgraduate college education warrants the investment. The student, however, faces several alternatives and has to select the one that yields the highest rate of return. The principal alternatives are three: attend college in the home country, the United States, or some other foreign country. Thus, foreign student demand for U.S. higher education should vary directly

TABLE 1

FOREIGN STUDENT MARKET SHARES

Country	Foreign Students from Country of Origin as Percentage of all Foreign Students in the U.S. (1978)	Foreign Students from Country of Origin in U.S. as Percentage of all Foreign Students from Country of Origin Studying Abroad (1977)	Principal Foreign Alternative to U.S. Higher Education (1977)
Asia:			
India	3.56	75.86	United Kingdom
Indonesia	.85	22.34	Germany
Korea	1.89	77.12	Germany
Philippines	.93	82.57	Japan
Taiwan	5.86	72.36	Japan
Mediterranean and Mideast:			
Greece	1.04	8.05	Italy
Iran	17.18	65.63	United Kingdom
Israel	.97	45.20	Italy
Kuwait	.74	76.15	United Kingdom
Lebanon	1.66	29.99	France
Saudi Arabia	3.05	88.31	United Kingdom
Turkey	.77	16.65	Italy
Africa:			
Ethiopia	.58	60.52	Italy
Kenya	.59	47.84	United Kingdom
Nigeria	6.15	68.67	United Kingdom

with the benefits of U.S. education, the costs of home education, and the costs of education in some third country and vary inversely with the benefits of home education, the benefits of education in some third country, and the costs of U.S. education.

Students do consider alternative countries when deciding where to attend college, and in some cases sponsoring governments negotiate with more than one country in deciding where to send students for special training. A recent survey reveals half the foreign students in the United States considered study in another country; the principal alternatives were the United Kingdom, Germany, and France.[3] In addition, table 1 shows the proportion of all students abroad who selected the United States for each country covered in this paper. For most countries a majority of students selected the United States for study.

The demand model postulated above assumes the supply of positions to foreign students is exogenous. In the United States, where foreign students represent a small proportion of all college students, where according to table 1 no country except Iran supplies a large proportion of all foreign students, and where there exists an abundance of enrollment-hungry institutions with low admission standards, this

assumption is not a strong one. While some elite colleges and universities may impose constraints on the number and composition of foreign students and some graduate programs may also face capacity constraints, in general foreign students wishing to study in the United States can do so.[4]

Data Limitations

A model of foreign student demand for U.S. higher education ideally would include variables representing each of the costs and benefits listed above. Unfortunately, much of the desired information either does not exist or does not exist in time series. Take, for example, the benefits of higher education. Time-series data on income differentials associated with being educated in different countries are not available for use either in this study or by prospective students. Given the absence of such information, it is unlikely that year-to-year variations in foreign student enrollments in the United States reflect changes in current income differentials, especially since the appropriate benefit measure is future income differentials as perceived by students.

One type of pecuniary benefit, however, is measurable and may be important in explaining foreign student flows to the United States. This is expected benefits should the student adjust his visa status and emigrate to the United States. Some students may enroll in United States institutions of higher education intending eventually to adjust their visa status. For these students adjustment of status may be an easier method of immigration than directly applying for an immigrant visa in the country of origin.[5] Other students, especially those receiving U.S. or home government financial aid, may find it very difficult to adjust status while in the United States but may establish contacts that later permit direct immigration. Most foreign students, however, probably enroll in U.S. institutions knowing only that there is a possibility of immigration. The expected benefits of immigration clearly may influence their enrollment decisions.

The demand model requires knowledge of the costs of higher education in the United States, the home country, and alternative countries. These costs include tuition and fees, opportunity costs, room and board, and travel expenses. Real tuition costs can be measured over time in the United States, which has an egalitarian educational system that allows most secondary school graduates access to higher education. Higher education in most developing countries and the principal European alternatives to the United States, however, tends to be elitist, charges very low tuition levels, and largely controls access through stiff examination standards or quotas imposed on the numbers of foreign students. For these countries the appropriate cost of higher education is some unknown shadow price or a proxy thereof. We assume here that the shadow price to foreign students in alternative

countries has remained relatively constant over time, although this assumption would not be true for recent years.[6] In addition, this assumption would not be valid for many developing nations that have experienced very rapid growth in higher education facilities and capacity in the past 2 decades. Thus, the shadow price of higher education in home countries is proxied by a measure of opportunity for higher education.

The student incurs opportunity costs whether he attends college at home or abroad, but the size of those costs may differ and thus influence the student's enrollment decision. In particular, the Immigration and Naturalization Service imposes restrictions on the employment of foreign students and their spouses in the United States, but in their home country many students might hold part-time or full-time employment while attending school.[7] In addition, the cost of room and board in the United States (and other alternative countries) typically exceeds the cost of room and board in the home country where the student is likely to remain living with the family. The student views differences in opportunity costs and living costs between the home country and the United States as part of the price of U.S. higher education. Lack of data forces us in this paper to assume student earnings in the home country are highly correlated with per capita income and living costs in the home country are zero or constant in real terms.

Last, travel expenses are difficult to determine given the plethora of travel modes and travel fares and the lack of good time-series data. The best proxy is travel distance which in a time-series analysis is, of course, constant.

Finally, as noted above, imperfections in capital markets imply that institutional or government financial aid and family income play important roles in student decisions where to attend college. Students can obtain financial aid from several sources: the home government, the U.S. government, alternative governments, and educational institutions themselves. There are, unfortunately, no good time-series measures of the aid available from any of these sources. Home government financial aid may be partly determined by national income and thus can be proxied by a measure of per capita income. Evidence suggests U.S. government support to foreign students has declined over time, but no adequate time-series exists for use in empirical work.[8] No information exists on the number of research assistantships open to foreign students and financed by U.S. research contracts and grants with universities. Similarly, there is no good time-series information on the number of scholarships or stipends awarded to foreign students by other countries. Lack of data forces us to omit this variable from the empirical analysis; the resulting bias to estimated coefficients is in general difficult to predict. However, if, as expected, the level of

financial assistance is positively correlated with income, the resulting coefficient on income will be biased upward.

The family income of prospective students is the single most important source of funds to finance the higher education of foreign students, especially at the undergraduate level where students are frequently ineligible for most forms of home government and U.S. government financial aid. Lacking data on family income of prospective students, we assume a good proxy is per capita income in the country. The eligible pool of college students in most countries studied is likely to be from families located at the upper tail of the income distribution. If the shape of the income distribution has remained constant over time, the proxy is a good one. However, several recent studies reveal income distribution has become less equal in many developing nations over the past 2 decades.[9] The result is that family income of prospective students may have increased more rapidly than per capita income. Complicating the issue is the fact that the size of the eligible pool, and thus the area under the income distribution representing families of prospective students, has also increased in size.[10] The resulting error in measurement of family income of prospective students is likely to bias the coefficient associated with income toward zero.[11]

III. Specification of the Model

The theory of foreign student demand and the data limitations discussed above result in an empirical model that postulates an individual's decision to attend college in the United States is affected by per capita income in the home country (Y), the price (P) or cost of U.S. higher education to the student, the opportunities (O) for higher education in the home country, and the expected benefits (B) of immigration to the United States. While this model explains the individual's decision, the number of students (F) from a particular country enrolling in U.S. institutions depends in part on the size of the college-eligible population (N) in the country of origin. The model of foreign student demand can thus be summarized:

$$F = f(Y, P, O, B, N). \tag{1}$$

Assuming the demand function is homogeneous of degree 1 with respect to N, the equation can be rewritten in terms of participation rates:[12]

$$F/N = f(Y, P, O, B). \tag{2}$$

Equation (2) represents demand for U.S. higher education by residents of a given country. In fact, the measure of educational opportuni-

ties applies only to undergraduates. No satisfactory measure exists to describe such opportunities for graduate students, and in most developing countries the graduate education offered is not a good substitute for that offered by industrialized nations, including the United States. Hence, while equation (2) is the model used to estimate the demand for undergraduate education in the United States, demand for graduate education is represented by equation (3), where F_g represents the number of students enrolled in graduate studies in the United States:

$$F_g/N = f(Y, P, B). \tag{3}$$

Definition of Variables

Two measures of foreign student demand are used in this study. One is the ratio of undergraduates (F_u) studying in the United States to the size of the eligible pool (N). Information on the number of undergraduates studying in the United States has its source in the annual survey of American colleges and universities conducted each year by the Institute of International Education (IIE) and reported in *Open Doors*.[13] These data are available by country for the period 1954–73 only; after 1973 total foreign students are not disaggregated by level of study.[14] The size of the eligible pool is the number of students enrolled in third-level education as reported to Unesco plus the number studying abroad; third-level enrollments are not disaggregated by undergraduate/postgraduate status.[15] Since most undergraduate foreign students in the United States had some prior college education in the home country, the eligible pool is lagged 2 years in constructing the participation rate.

The second measure of foreign student demand is the ratio of postgraduate students in the United States to the size of the eligible pool. Again, the eligible pool is measured by total third-level enrollments.[16]

Since data on family incomes were not available by country over time, the measure of income employed is per capita income expressed in constant 1972 dollars. The principal sources of these data were the International Monetary Fund and the Agency for International Development.

No satisfactory time series exists on the price of U.S. higher education to foreign students. The only time series on tuition does not include out-of-state tuition charges. Hence, a time series was constructed for this paper by surveying randomly selected colleges and universities from among the top one hundred in the United States in terms of numbers of foreign students. Average out-of-state tuition charges and average room and board costs for the United States were computed from this survey and expressed in constant 1972 dollars.

Opportunity for higher education in the home country was defined

here as the number of students enrolled in colleges and universities per one hundred students in secondary education. Preferred measures of opportunity such as the ratio of students entering college to the number of high school graduates or the acceptance ratio of applicants to college do not exist in time series.

Last, expected immigration benefits are defined as the probability that students from a particular country adjust their status to immigrant multiplied by the ratio of U.S. per capita income to home country income, both expressed in constant dollars. The probability of adjusting status is the ratio of the number of students from a given country adjusting status to immigrant as reported by the INS in its *Annual Report* to the number of foreigners from that country studying in the United States. This measure obviously does not include those students who return to their home country and later directly emigrate to the United States.

The data used to estimate the models consist of annual observations from 1954 to 1973, although lagging the eligible pool of students by 2 years results in only 17 observations. There are no observations after 1973 because that is the final year the IIE collected data on numbers of undergraduate and postgraduate students aggregated by country of origin. Also, in that year the IIE changed its survey format and again changed the definition of foreign student.

The Sample

Fifteen of the principal Eastern Hemisphere importers of U.S. higher education services are included in this empirical analysis; the countries are listed in table 2. As noted earlier, Western Hemisphere countries and Western European countries were excluded because until 1977 they were treated differently by U.S. immigration rules and regulations. For much of the time period studied, Asian and African nations faced very small quota limits, while European countries had large quotas that were often not fully used, and Western Hemisphere nations faced no quotas at all. Also, in the period 1965–76 Western Hemisphere students could not adjust their status to immigrant.

A further reason for selecting these 15 nations is the rapid increase of growth of foreign students originating in those nations. Table 2, in addition to giving the means and variances of all the variables, shows the rate of growth in enrollments from these countries over the period 1954–73 and, for purposes of comparison, 1974–79. In general, the proportion of all foreign students from Asia increased from 41.6% in 1954 to 55.7% in 1979 and the percentage from Africa increased from 3.6% to 12.9% while Europe's share declined from 15.2% to 8.2% and Latin America's share dropped from 24.7% to 15.6%.

TABLE 2

MEANS AND STANDARD DEVIATIONS (In Parentheses) OF VARIABLES BY COUNTRY, 1954–73

Country	Undergraduate Demand 100* (Fu/N)	Graduate Demand 100* (Fg/N)	Real Income (1972$) ($Y$)	Benefits (B)	Educational Opportunity 100* (O)	Rate of Growth in ($Fu + Fg$) (1954–73)	Rate of Growth in ($Fu + Fg$) (1974–78)
Asia:							
India	.08	.33	92.67	11.00	13.11	.094	−.005
	(.02)	(.06)	(9.79)	(5.97)	(3.47)		
Indonesia	.18	.35	77.61	4.99	9.17	.084	.156
	(.10)	(.23)	(11.80)	(2.38)	(2.10)		
Korea	.84	1.34	227.17	4.75	11.25	.057	.080
	(.51)	(.19)	(102.06)	(2.82)	(1.30)		
Philippines	.17	.34	123.07	15.47	39.63	.026	.029
	(.05)	(.09)	(19.54)	(9.47)	(4.04)		
Taiwan	2.81	6.49	358.42	3.72	14.39	.061	.086
	(2.57)	(2.00)	(146.43)	(2.57)	(4.56)		
Mediterranean and Mideast:							
Greece	1.92	1.21	960.46	.86	15.31	.037	.078
	(.83)	(.23)	(397.52)	(.30)	(4.38)		
Iran	7.28	2.74	432.47	1.42	6.77	.120	.269
	(1.96)	(.42)	(164.02)	(.49)	(.70)		
Israel	2.53	2.69	1585.58	.31	33.77	.049	.015
	(.78)	(.57)	(498.87)	(.07)	(9.12)		
Kuwait	15.54	4.39	6379.00	.26	4.87	.220	.153
	(11.28)	(2.10)	(2858.27)	(.04)	(2.34)		
Lebanon	2.79	1.46	291.07	2.98	23.84	.090	.226
	(1.57)	(6.16)	(182.70)	(1.13)	(3.95)		
Saudi Arabia	8.86	4.13	1381.95	.01	10.25	.178	.392
	(3.313)	(9.19)	(319.53)	(.001)	(1.99)		
Turkey	.45	.67	375.21	1.15	13.18	.065	.075
	(.19)	(.06)	(93.15)	(.56)	(1.44)		
Africa:							
Ethiopia	9.03	8.59	35.98	5.25	5.74	.164	−.058
	(3.99)	(2.78)	(6.33)	(2.67)	(2.81)		
Kenya	16.03	8.01	80.63	4.41	3.94	.185	.125
	(4.15)	(4.16)	(14.25)	(2.63)	(1.44)		
Nigeria	9.90	7.11	123.82	2.95	3.74	.155	.176
	(2.56)	(1.66)	(26.68)	(1.78)	(1.64)		

Estimation Procedure

The functional forms of equations (2) and (3) are assumed to be exponential. This functional form permits the direct estimation of income and price elasticities and enables one to compare estimates obtained here with those derived in earlier studies of the demand for higher education. Equation (2) can thus be expressed

$$F_u/N = \alpha Y^{\beta} P^{\gamma} O^{\Psi} B^{\theta}, \tag{4}$$

where F_u is the number of undergraduates from a given country studying in the United States.

The principal difficulty in directly estimating equation (4) is multicollinearity among the independent variables. In particular, as noted in earlier studies of consumer demand, the explanatory variables tend to move together over time.[17] To reduce the degree of collinearity, we use the procedure earlier adopted by Stone and estimate the income elasticity using cross-sectional data and then adjust the dependent variable used in the time series.[18] Since the cross-section price and U.S. income do not vary, the cross-sectional model becomes

$$F_u/N = \alpha Y^{\beta-\theta} O^{\Psi} R^{\theta}, \tag{5}$$

where R is the proportion of students adjusting status to immigrant.[19]

Once equation (5) is estimated and a value of $\beta - \theta$ obtained, the time-series model can be adjusted as follows:[20]

$$(F_u/N) \times Y^{\hat{\theta}-\hat{\beta}} = \alpha P^{\gamma} O^{\Psi} B'^{\theta}, \tag{6}$$

where B' equals the probability of adjusting status (R) multiplied by U.S. per capita income. Equation (6) is estimated and the results reported below.

IV. Results

The first step in estimating undergraduate and postgraduate demand for U.S. higher education is to estimate the cross-sectional model as represented by equation (5) for undergraduates and equation (5) with O deleted for postgraduates. To increase sample size in the cross-sectional estimation, all low- and middle-income countries ($N = 25$) in the Eastern Hemisphere for which data could be obtained were included in the sample. In addition, in the results reported here data were pooled over the 3-year period 1972–74.

Equation (5) was modified slightly in these regressions to account for costs that may be associated with learning a foreign language. Thus, a dummy variable taking the value one if the country of origin is English speaking and zero otherwise was added to the log-linear regres-

sion. In addition, a similar dummy variable was constructed for French-speaking countries under the assumption that students from those countries might find the alternative of education in France to entail lower adjustment costs relative to the United States.

The estimated results are given in table 3. The sign of the exponent on income was not predicted because it incorporates both a positive income elasticity and the negative elasticity associated with immigration benefits and forgone earnings. The results given in table 3, however, show the income exponent to be small and positive for undergraduate demand but not statistically different from zero for postgraduates.[21]

The other estimated coefficients in general have the expected signs, and educational opportunity is significantly related to undergraduate demand. Surprisingly, the coefficient on French speaking is positive for undergraduates, which implies the higher costs of learning English to study in the United States are more than offset by some positive effect on U.S. demand associated with French-speaking countries, perhaps a familiarity with Western culture.

Time-Series Results

Since the cross-sectional results do not allow rejection of the null hypothesis that the exponent on income is zero for graduate foreign students, the adjustment specified in equation (6) is to simply delete the income variable from the time-series regressions.[22] For undergraduates, however, the income elasticity is assumed to be 0.37 in adjusting the left-hand variable for the time-series regressions. The resulting estimates for equation (6) for undergraduates are given in table 4.

The estimated coefficients typically are of the expected sign. The statistically significant estimates of price elasticities are negative and range in size from -0.47 to -2.99. The exponents associated with educational opportunities are consistently negative. And the elasticities on immigration benefits are usually positive but statistically significant for only three countries. The null hypothesis of no serial correlation cannot be rejected.

The time-series estimates for the graduate student equation are given in table 5. The results are similar to those obtained for the undergraduate model in that price is usually negative and statistically significant. Immigration benefits are significantly related to demand for very few countries. The hypothesis of no serial correlation cannot be rejected.

V. Discussion

Though for most countries the number of foreign students in the United States has increased over time, the size of the eligible pool or popula-

TABLE 3

CROSS-SECTIONAL ESTIMATES FOR LOW- AND MIDDLE-INCOME EASTERN HEMISPHERE COUNTRIES
(Standard Errors in Parentheses)

Dependent Variable	Constant	Income	Educational Opportunity	English Speaking	French Speaking	Adjust Status	SE	R^2
Undergraduate	−.637	.369*	−2.493**	.498	.958*	.299	1.629	.60
foreign students	(1.359)	(.202)	(.326)	(.344)	(.584)	(.314)		
Graduate	−5.006**	−.047		.406	−1.119**	−.505	1.660	.14
foreign students	(1.255)	(.183)	...	(.345)	(.495)	(.373)		

* Statistically significant at the .10 level or better.
** Statistically significant at the .05 level or better.

TABLE 4

TIME-SERIES ESTIMATES FOR UNDERGRADUATE FOREIGN STUDENTS BY COUNTRY, 1954–73

Country	Constant	Price	Opportunity	Benefits	SE	D-W	R^2
Asia:							
India	−5.811**	.123	−1.607**	.026	.015	.88	.43
	(1.905)	(.352)	(.466)	(.065)			
Indonesia	1.593	−.895	−1.968**	.062	.391	1.58	.79
	(4.76)	(.974)	(.492)	(.190)			
Korea	1.891	−1.210**	−.091	.074	.009	1.31	.90
	(3.064)	(.298)	(.451)	(.056)			
Philippines	−1.271	−.468*	−.953	.027	.005	2.60	.47
	(3.350)	(.222)	(.546)	(.048)			
Taiwan	7.596	−1.523	−.516	−.169	.216	1.35	.72
	(7.578)	(1.304)	(1.447)	(.249)			
Mediterranean and Mideast:							
Greece	2.518*	−.870**	−1.172**	.104	.009	1.57	.96
	(1.349)	(.204)	(.229)	(.171)			
Iran	6.721**	−1.197**	−1.027**	−.058	.011	1.39	.94
	(1.067)	(.256)	(.232)	(.194)			
Israel	3.786	−1.357*	−.179	.124	.017	.77	.90
	(2.431)	(.601)	(.578)	(.185)			
Kuwait	−3.274	−.223	−.936*	.293	.009	1.97	.98
	(8.906)	(1.229)	(.292)	(.187)			
Lebanon	3.428**	−1.165**	−.779**	.347**	.009	2.23	.92
	(.944)	(.255)	(.318)	(.125)			
Saudi Arabia	20.243**	−2.836**	−1.280	−.084	.032	1.41	.94
	(3.706)	(.352)	(.728)	(.101)			
Turkey	18.436**	−2.278**	−3.062**	−.132	.030	.90	.90
	(5.358)	(.279)	(1.29)	(.174)			
Africa:							
Ethiopia	−11.036**	.725	−.017	.304**	.048	1.99	.70
	(3.919)	(.475)	(.284)	(.102)			
Kenya	21.399**	−2.997**	−1.772**	.107	.091	.88	.93
	(7.580)	(1.238)	(.854)	(.276)			
Nigeria	−6.604*	.547	−.403*	−.198	.025	1.66	.43
	(3.201)	(.537)	(.214)	(.166)			

* Statistically significant at the .10 level or better.
** Statistically significant at the .05 level or better.

TABLE 5

TIME-SERIES ESTIMATES FOR GRADUATE FOREIGN STUDENTS BY COUNTRY, 1954–73

Country	Constant	Price	Benefits	SE	D-W	R^2
Asia:						
India	−.072	−.749**	.031	.151	1.69	.67
	(1.463)	(.217)	(.050)			
Indonesia	11.427**	−2.206**	−.041	1.460	.93	.67
	(5.662)	(.924)	(.352)			
Korea	−1.632	−.427**	.096*	.084	1.66	.39
	(1.055)	(.167)	(.051)			
Philippines	2.909**	−1.082**	.038	.056	1.55	.94
	(.921)	(.150)	(.046)			
Taiwan	8.697**	−1.516**	.032	.614	2.51	.90
	(1.319)	(.194)	(.049)			
Mediterranean and Mideast:						
Greece	.929	−.654**	−.048	.100	.98	.76
	(1.301)	(.123)	(.176)			
Iran	−.075	−.524	.083	.221	1.53	.38
	(1.500)	(.353)	(.273)			
Israel	2.764**	−.699**	−.162	.053	2.23	.90
	(.670)	(.110)	(.098)			
Kuwait	37.173*	−5.338**	.737	.040	1.94	.94
	(8.670)	(1.191)	(.299)			
Lebanon	7.254**	−1.850**	.432**	.061	2.32	.94
	(.933)	(.171)	(.100)			
Saudi Arabia	−4.216	.152	−.044	.261	1.34	.44
	(2.848)	(.367)	(.109)			
Turkey	−2.778**	−.276**	−.016	.075	.86	.42
	(1.012)	(.102)	(.085)			
Africa:						
Ethiopia	2.542**	−.699**	.059	.135	2.56	.77
	(1.067)	(.137)	(.045)			
Kenya	12.870**	−1.864**	−.197	.682	1.15	.86
	(4.822)	(.769)	(.234)			
Nigeria	−2.116	−.167	.131	.120	1.47	.17
	(1.261)	(.213)	(.096)			

* Statistically significant at .10 level or better.
** Statistically significant at .05 level or better.

tion has increased even more rapidly. Over the past 25 years participation in secondary education has risen from a minority of the population to a majority of the population for most of the countries studied here. Although a very small proportion of secondary school graduates can gain access to higher education, the number of college students has often increased even more rapidly than secondary school enrollments. The assumption made in this paper is that, ceteris paribus, a given percentage increase in the eligible population results in the same percentage increase in foreigners from that country studying in the United States.

In fact, however, the proportion of all college students who elect to study in the United States has been declining for the preponderance of countries of origin. While other factors offer potential explanations of this phenomenon, we have been able to test only the explanatory power of income, price, educational opportunity, and immigration benefits.

The income elasticity of demand was estimated using cross-sectional data and found to be small and statistically significant for undergraduates but insignificant for postgraduates. As noted earlier, per capita income may be a poor measure of income of the eligible population, and this may explain its weak predictive power. Studies of domestic demand for U.S. higher education typically find large and statistically significant income elasticities.

The increasing price of U.S. higher education is one explanation for the declining percentage of students attending U.S. colleges and universities. Tuition plus room and board have increased from $1,155 in 1954 to $3,542 in 1973. According to the regression results, this increase reduced demand by relatively large amounts for both undergraduate and graduate foreign students.

Opportunities for higher education in the country of origin are strongly and negatively related to demand for U.S. higher education in both the cross-sectional and time-series regressions. Nigeria was among the countries that experienced the greatest improvement in educational opportunities between 1954 and 1973 with the ratio of college to secondary school enrollments increasing from .018 to 0.45. That improvement decreased demand for U.S. undergraduate education by 60%. Had educational opportunities not increased, the number of Nigerian undergraduates studying in the United States would have been 4,229 in 1973 instead of the actual 3,201.

Last, immigration benefits apparently play a relatively unimportant role in attracting foreigners to study in the United States. For undergraduates such benefits are significantly related to demand only in Indonesia, Lebanon, and Ethiopia, and the elasticities are all small. For postgraduates immigration benefits are significantly related to demand only in Korea and Lebanon, and again the elasticities are small. Interestingly, each of the countries for which immigration benefits are important has experienced civil war or domestic strife in recent years. Also, the lack of a statistically significant relationship for the Philippines is striking given its high level of benefits and the difficulty in directly immigrating to the United States from that country.[23]

OPEC Enrollment

Unfortunately, the IIE changed its survey procedures after 1973 and ceased collecting data on foreign students disaggregated by academic level. As a result, we cannot precisely test the predictive power of the

estimated equations. Quite clearly, however, these results do not satisfactorily predict growth in enrollments of students from the OPEC countries.

The number of OPEC foreign students in the United States grew from 29,700 in 1974 to 73,550 in 1977, an increase of 148%. After academic year 1977 the rate of growth slowed appreciably. Two countries in our sample, Iran and Saudi Arabia, are representative of this growth. The growth in Iranian foreign students between 1974 and 1977 was 22,440, which exceeded the growth in foreign students from all countries in the preceding 5-year period. The number of Saudi Arabian students, on the other hand, increased by only 5,020, but this represented an increase of 325%. The equations estimated here underpredict the growth in foreign students from these two countries.

All the reasons for underprediction are not easily ascertained, but the principal explanation appears fairly straightforward. Although one cannot obtain precise numbers, both Iran and Saudi Arabia greatly increased financial aid to students studying abroad in this time period.[24] Such financial aid appears to be part of an overall strategy of investment in human capital consistent with the ambitious development plans of both countries. The fulfillment of those plans was, of course, in large part financed by the rapid growth in revenues from oil exports in both countries.

In fact, both Iran and Saudi Arabia increased educational expenditures at a rate much more rapid than the growth in GNP. For example, while GNP increased at an annual rate of 18.1% in Iran and 22.0% in Saudi Arabia between 1974 and 1976, educational expenditures increased annually by 57.8% and 77.0%, respectively, in the same time period.[25] The elasticity of educational expenditures with respect to GNP is higher in general for OPEC than for other developing countries. In addition, for OPEC countries this elasticity was higher after than before 1974.[26]

The tremendous growth in human capital investment among OPEC countries, in addition to reflecting the growth in GNP, may have resulted from the relative ease with which such investment could be undertaken relative to time-consuming physical investment. Furthermore, the large growth in secondary school enrollments over the previous decade in most OPEC countries meant human capital investment via higher education abroad was one which could be undertaken with almost no lag. Such highly educated manpower would be viewed as necessary for the successful implementation of development plans and for the future staffing of national institutions of higher education.

Predicted Enrollments

The estimated equations permit prediction of changes in demand associated with changes in independent variables. In 1977 Unesco issued

TABLE 6

ACTUAL 1977 ENROLLMENTS AND PREDICTED ENROLLMENT CHANGES, 1977–85

COUNTRY	ACTUAL TOTAL ENROLLMENTS, 1977	PREDICTED PERCENTAGE CHANGE IN ENROLLMENTS, 1977–85	
		Undergraduate	Postgraduate
Asia:			
India	9,080	46.4	7.8
Indonesia	1,820	34.2	59.8
Korea	4,220	26.4	27.6
Philippines	2,070	18.3	19.1
Taiwan	13,650	n.a.	n.a.
Mediterranean and Mideast:			
Greece	2,490	n.a.	n.a.
Iran	36,220	80.9	105.5
Israel	2,550	66.7	67.1
Kuwait	1,810	n.a.	n.a.
Lebanon	3,370	35.3	33.7
Saudi Arabia	6,560	104.5	87.9
Turkey	1,850	−11.9	3.4
Africa:			
Ethiopia	1,570	180.0	180.6
Kenya	1,430	153.7	208.6
Nigeria	13,510	48.3	46.8

projections of secondary and higher education enrollments by country through the year 1985. These projections can be used to calculate the size of the eligible population and educational opportunities in 1985. The estimates of eligible population and educational opportunities, in turn, can be inserted into the estimated demand equations to predict changes in foreign student enrollments over time, assuming the values of other variables are held constant. In table 6, the predicted percentage changes in undergraduate and graduate enrollments between 1977 and 1985 are reported using this procedure.[27] The results suggest continued growth in foreign student enrollments in the United States, but the international composition of students will change. In addition, graduate student enrollments are expected to increase more, in general, than undergraduate enrollments.

Unforeseen events may, of course, alter these predictions. For example, several state legislatures have entertained proposals to increase out-of-state tuition and remove the subsidy many foreign students now receive in public higher education.[28] Thus, the price of U.S. higher education may increase more rapidly than expected. Also, per capita income in some developing countries will grow faster than U.S. per capita income, thereby reducing the size of immigration benefits. And changes in U.S. immigration legislation may also reduce expected immigration benefits by increasing the difficulty of adjusting status.[29]

Last, political events such as the civil war in Lebanon or the revolution in Iran often increase foreign student demand in the short run while decreasing it in the long run.

VI. Conclusions

The study reported here is an attempt to estimate the demand by foreign students for U.S. higher education. The number of foreign students has increased dramatically since 1954, and their financial importance to institutions of higher education will grow as domestic enrollments decline in the next decade.

The number of foreign students in the United States has increased in large part because the eligible populations have increased, especially in the nonindustrialized countries of the world. Enrollments in secondary and higher education in those countries have grown even more rapidly than the number of foreign students in the United States. The empirical portion of this study reveals that the ratio of foreign students in the United States to the eligible population has declined over time due to two primary factors, the rising real cost of U.S. higher education and, at the undergraduate level, improved higher education opportunities in the countries of origin. For most countries the elasticities associated with these variables are relatively large. Except for a small number of countries, the benefits associated with the adjustment of student visa status to immigrant are not an important determinant of foreign student demand.

The estimated demand equations indicate that, if Unesco projections of growth in secondary and higher education enrollments are accurate, the total number of foreign students in the United States will increase substantially by 1985.

Notes

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1. The relation of the theory of human capital to domestic demand for higher education is particularly well expostulated in Robert Campbell and Barry N. Siegel, "The Demand for Higher Education in the United States," *American Economic Review* 57 (June 1967): 482–94; Arthur J. Corazzini, Dennis J. Dugan, and Henry G. Grabowski, "Determinants and Distributional Aspects of Enrollments in United States Higher Education," *Journal of Human Resources* 7 (Winter 1972): 39–59; Harvey Galper and Robert M. Dunn, Jr., "A Short-Run Demand Function for Education in the United States," *Journal of Political Economy* 77 (September/October 1969): 765–77.

2. While the various studies have studied different aspects of the demand for higher education and ultilized different samples and units of observation,

they all share a common theoretical framework. Feldman and Hoenack used Project Talent data in a cross-sectional analysis of variation in higher education enrollment rates across states; their study emphasized the role of tuition and the income benefits perceived by prospective students; Paul Feldman and Stephen Hoenack, "Private Demand for Higher Education in the United States," in *The Economics and Financing of Higher Education in the United States* (Washington, D.C.: Government Printing Office, 1969), pp. 375–95. Campbell and Siegel did a time-series analysis of national enrollment rates to estimate tuition and income elasticities of demand. Galper and Dunn also used national time-series data to estimate a model that expressed, in first-difference form, undergraduate enrollments as a function of household income and distributed lags of high school graduates and growth of the armed services. Corrazzini et al. used Project Talent data to analyze across-states higher education enrollment rates disaggregated by socioeconomic status groupings of prospective students. Their study focuses on tuition rates and opportunity costs as determinants of enrollment rates; their study also specifically considers (but does not incorporate in the empirical model) the determination of tuition charges and rationing criteria on the part of the suppliers of higher education.

3. William Glaser, *The Brain Drain* (London: Pergamon Press, 1978), p. 197.

4. In fact, foreign student enrollments continued to increase during the rapid growth in domestic enrollment in the 1960s, suggesting they faced no constraint in U.S. higher education capacity.

5. This is especially true if the waiting time for an immigrant visa is long. Also, since professional immigrants need to obtain an offer of employment prior to receiving a visa, study in the United States provides a means of establishing employment contacts.

6. In recent years several countries including Denmark, the Netherlands, Germany, France, and Great Britain have imposed quotas on overall numbers of foreign students and quotas on foreign students in particular fields of study. For further discussion of these restrictions, see Alan Smith, Christine Woesler de Panafieu, and Jean-Pierre Jarousse, "Foreign Student Flow and Policies in an International Perspective," *The Overseas Student Question,* ed. Peter Williams (London: Heineman, 1981), pp. 165–222. In addition, Great Britain began increasing foreign student fees in 1976, with large changes in 1977 and 1979; currently, foreign student charges in Britain are approximately equal to private higher education tuition in the United States. For a discussion of the impacts of these increases on foreign student enrollments, see Mark Blaug, "The Economic Costs and Benefits of Overseas Students," also in Williams, pp. 47–90.

7. Thus the difference in opportunity cost between attending college at home and attending one in the United States is the income that could have been earned while attending college. While we have no measure of such earnings, they may be highly correlated over time with per capita income in the country of origin. There have been some changes in U.S. laws and regulations regarding the work of foreign students and their families which affect the total costs of U.S. higher education as seen by the student. For example, the 1961 Mutual Educational Exchange Act for the first time allowed spouses of needy foreign students to work. More recently, as reported in *Interpreter Releases* (May 14, 1974), the Immigration and Naturalization Service (INS) has made it more difficult for students to obtain summer work permits. Other countries typically have regulations on foreign student work that are at least as restrictive as those in the United States.

8. For example, as reported in unpublished data provided by the Office of

International Participant Training of the U.S. State Department, total arrivals of foreign students supported by the U.S. Agency for International Development declined from 6,827 in 1964 to 902 in 1979. Similarly, the number of students supported by Fulbright fellowships has suffered a decline from 1,853 in 1966 to 922 in 1976; these data are derived from various issues of the *Annual Report of the Board of Foreign Scholarships*.

9. For example, see M. S. Ahluwalia, "Inequality, Poverty, and Development," *Journal of Development Economics* 3 (December 1976): 307–42.

10. For example, according to Unesco the percentage of 18–23 year-olds enrolled in school in developing nations more than doubled between 1960 and 1975 (Division of Statistics on Education, Unesco, *Trends and Projections of Enrollment by Level of Education and by Age* [Paris: Unesco, 1977]).

11. Levi demonstrates that if only one independent variable in a multivariate regression is measured with error, the coefficient associated with that variable is unambiguously biased toward zero; Maurice Levi, "Error in the Variables Bias in the Presence of Correctly Measured Variables," *Econometrica* 16 (September 1973): 85–186. Two phenomena are likely to result in errors in measurement of income in the current study. First, in the process of economic development income distribution typically becomes first less equal and later more equal. Since most of the countries in our sample can be presumed to be in the first stage, where income is becoming less equally distributed, the income of eligible students has probably increased more rapidly than observed per capita income. Second, participation rates in secondary education tend to increase rapidly with income of the country. The result is the size of the eligible pool and the proportion of the total population in the eligible pool for U.S. higher education grows with income. Consequently, the income of eligible students has probably increased less rapidly than observed per capita income. While error in measuring income biases the coefficient toward zero, omission of a financial aid variable probably imparts an upward bias to the coefficient. The net bias is indeterminate.

12. While this is a common assumption in studies of the domestic demand for higher education, it implies that changes in the size of the eligible population, N, do not entail compositional changes that affect the size of F.

13. The measure of demand employed in this study is the stock of undergraduates in the U.S. to the stock of all college students studying at home and aboard. While the IIE survey requested data on the flow of new students to the United States from 1954 to 1973, the response rate on the length of study has typically been very poor. In addition, using flow data does not permit disaggregation by undergraduate/postgraduate status, and no comparable data exist on flows of students in the home country.

14. Unfortunately, the definition of foreign student used in the IIE survey has changed over time. The IIE data on foreign students from each country prior to 1966 include only nonimmigrants, while data reported for 1966–69 include both immigrants and nonimmigrants. Data for the period 1970–73 separately report immigrant and nonimmigrant students. Assuming the ratio for nonimmigrants to total students is the same for 1966–69 as for 1970–73, the adjusted stock of nonimmigrant students for 1966–69 is computed by multiplying that ratio times the IIE-reported totals.

15. The Division Office of Educational Statistics of Unesco in Paris generously provided us with unpublished data on second-level and third-level enrollments over time. Data on students abroad were obtained from the *Unesco Statistical Yearbook* and its predecessor *Basic Facts and Figures*. While one might argue the number of secondary school graduates in a given age group is a better measure of the eligible population, such data do not exist for most

countries. Secondary school enrollments is a poor proxy for graduates given the wide variation in retention rates between countries and over time.

16. Again, a better measure of the eligible pool would be the number of college graduates in a given age group or the number of students enrolled in graduate school anywhere, but such data do not exist. If retention rates in higher education remain relatively constant over time, third-level enrollments is a good proxy for the stock of recent college graduates.

17. In the terminology of Rao and Miller, income is a dominant variable; see Potluri Rao and Robert Miller, *Applied Econometrics* (Beverly Hills, Calif.: Wadsworth Publishing Co., 1971). For example, regression of the income variable on the other independent variables results in a coefficient of multiple correlation ranging from 0.56 to 0.98. Income is not highly correlated with other independent variables in cross-sectional analysis.

18. Richard Stone, *The Measurement of Consumer's Expenditure and Behavior in the United Kingdom 1920–1938* (Cambridge: Cambridge University Press, 1954).

19. Immigration benefits, B, are defined as the proportion, R, of students adjusting status times the ratio of U.S. per capita income, Y_{us}, to home country income, Y. Y_{us} is constant in a cross-section and Y is an independent variable, leaving R as the measure of immigration benefits.

20. As noted earlier, the exponent on income (labeled X_1 here) obtained from the cross-sectional regression has some indeterminate bias. The bias may in turn affect the estimated coefficients of the independent variables in the time-series regressions. For example, in the case of a linear regression with k independent variables, one can demonstrate that plim $\hat{\beta}_2 = \beta_2 + (\beta_1 - \text{plim}\ \hat{\beta}_1)\, b_{12.3,\ldots,k}$ where $b_{12.3,\ldots,k}$ is the regression coefficient on X_2 when the variable X_1 measured without error is regressed on all other independent variables in the time-series regression. Since we do not have variable X_1 measured without error, we cannot determine the magnitude of the biases imparted to the coefficients $\hat{\beta}_2, \ldots, \hat{\beta}_k$ even if the bias of $\hat{\beta}_1$ itself is precisely known. If, however, we believe the observed X_1 is a sufficiently good proxy of the true X, we can determine the direction of the biases in the time-series models by regressing observed X_1 on all other independent variables. Unfortunately, in our case the nature of the bias of $\hat{\beta}_1$ itself is unknown. Hence, the bias given to other coefficients in the model is indeterminate. However, experimentation indicates the magnitude and statistical significance of coefficients in the time-series models are not highly sensitive to a reasonable range of assumed values for the income elasticity.

21. This pattern of results is consistent with the fact undergraduates depend almost completely on family income as a source of finance, whereas postgraduates frequently receive financial aid from a variety of national and international sources.

22. An alternative method adjusts the dependent variable as shown in eq. (6) by assuming the true income exponent is the one estimated in the cross-sectional graduate regression. This adjustment affected the estimated structures of the models only slightly.

23. The Philippines has for several years had the longest backlog of applicants for immigrant visas of any country. For example, in 1977 the average time for a professional to obtain an immigrant visa was 8 years.

24. The lack of either consistent cross-sectional or time-series data on financial aid for study abroad prevented including such a variable in the empirical model. Neither Saudi Arabia nor Iran reports the number of students aided or the level of financial support, but the Saudi mission in Washington reports that approximately 90% of all Saudi foreign students in the United States

receive government assistance. The Information Office of Amideast also reports that the Pahlavi foundation in Iran increased financial assistance to Iranian foreign students in the 1970s.

25. J. C. Eicher and F. Orivel, *The Allocation of Resources to Education throughout the World* (Paris: Unesco, 1980).

26. For example, Eicher and Orivel calculate an elasticity of +1.79 for OPEC countries for 1974–76 compared to an elasticity of +0.97 for other developing countries in the period 1970–74.

27. As noted earlier, eq. (2) assumes demand is linearly homogeneous of degree 1 in the size of the eligible population. The predicted change in postgraduate enrollments between 1977 and 1985 is thus identical to the predicted change in third-level enrollments given by Unesco. The predicted changes in undergraduate enrollments for the same period are equal to the sum of the impacts of changes in the eligible population and changes in educational opportunities as given in the Unesco document.

28. As an example, out-of-state tuition charges at the University of California cover less than half the average recurrent costs of instruction.

29. The most important recent development as cited by *Interpreter Releases* (March 30, 1977) was the INS's discarding of the practice called "automatic extended voluntary departure," which allowed applicants for adjustment of status having approved labor certification to remain the the United States while awaiting an immigrant visa.