Education and Migration: A Global Perspective

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There is renewed interest in the effects of the flow of human capital out of low-income countries

Recent development of data base on "brain drain" (Beine et al., 1999 and 2006) from Census data

Show large proportion of highly-educated persons born in low-income countries residing in high-income countries

Examples: 82% of tertiary-educated Jamaicans reside outside Jamaica

43% of tertiary-educated Ghanaians reside outside Ghana

But also, large variation in proportions across sending countries

Little work on what determines variation in the quantity and quality of immigrants across counties of the world: the education level of workers who choose to migrate

First major study (Borjas, 1987) only looked at variation across **41** sending countries in quality and quantity of immigrants

> Small sample, and, moreover, a choice-based sample: countries included only those with many immigrants!
>
> Little support for framework used (Roy model)

That study, and almost all subsequent empirical work examining the global flow of immigrants hampered by data constraints

Even less research on the determinants of the acquisition of foreign schooling

In particular, the immigration literature has three deficiencies in studying the determinants of the number and quality of immigrants:

1. Existing frameworks and data up to now inadequate to describe appropriately measures of (large) gaps in rewards to skill across countries

e.g., pervasive use of per-capita GDP as a measures of skill-specific wages

2. Empirical analyses, based on census data, lump together immigrants selected via family reunification rules and those selected on the basis of skill and jobs.

Decision rules are likely to be quite different for the two groups.

Indeed, permanent resident aliens in the US are admitted mostly (90%) based on family criteria and subject to country ceilings

3. Inattention to reverse flows of skilled persons: foreign skill acquisition and the return migration of "permanent" immigrants

Outline

1. Describe components of "brain drain" measures

2. Discuss international wage gaps, skills and wage determination and the Mincer model of schooling-wage relationships used in most immigration studies

3. Present simple one-skill model of migration flows and migration selectivity for workers with given skill

4. Extend the model to examine the choice of schooling abroad, in low-income countries

5. Discuss the identification of skill prices from micro and cross-country aggregate data, relationship to GDP

6. Describe the immigrant data bases available for identifying country-specific wages and skill prices

7. Estimation strategies and results using the new data:

    A. Tests of Mincer model of international wage gaps. B. Determinants of the number and quality of immigrants. C. Determinants of return rates of foreign students. D. Determinants of intentions to return by "permanent" immigrants, by skill

8. Conclusions: From the perspective of sending countries

The Measurement of "Brain Drain"

Two alternative definitions (there are others):

1. The proportion of highly-educated persons born in a country living outside the country at a point in time.

Recent estimates of this definition of "brain drain" based on Census-type data, supported by the World Bank (Docquier and Marfouk, 2004) [D-M],

Brain drain (BD_i) for country i = $\Sigma FB_{ij}/(S_i + \Sigma FB_{ij})$

where FB_{ij} = tertiary-educated persons aged 25+ born in country i residing in destination country j

S_i = tertiary-educated persons residing in origin-country i

2. The number or proportion of already highly-educated persons who left low-income countries for high-income countries ("net brain drain"); i.e.,

the emigration only of *those educated in the sending countries*:

$$NBD_i = (\Sigma FBH_{ij})/(S_i + \Sigma FBH_{ij} - \Sigma SFB_{ij})$$

where FBH_{ij} = Foreign-born residents educated in i living in j

SFB_{ij} = Home-country residents in i educated in j

A. Many FB in destination countries received their schooling there, not in their home country. Thus the BD numerator is a biased upward of the outflow of skilled.

B. However, this NBD measure still ignores the fact that some S "stayers" also received their schooling in the destination country and then returned. These returning "foreign" students should be subtracted from the NDB denominator.

Relatively little attention to the training of students from low-income countries in high-income countries

But there is a great deal of foreign, outsourced education

UNESCO:

A. Over 2 million foreign students enrolled in tertiary schools in 2005

B. Five host countries dominate (80%) in attracting foreign students:

the United States, the United Kingdom, Australia, Japan, Germany

C. Large variation in proportions of foreign students by country, many from low-income countries

Figure 1. Annual Number of Foreign Student Visas Issued, by Receiving Country

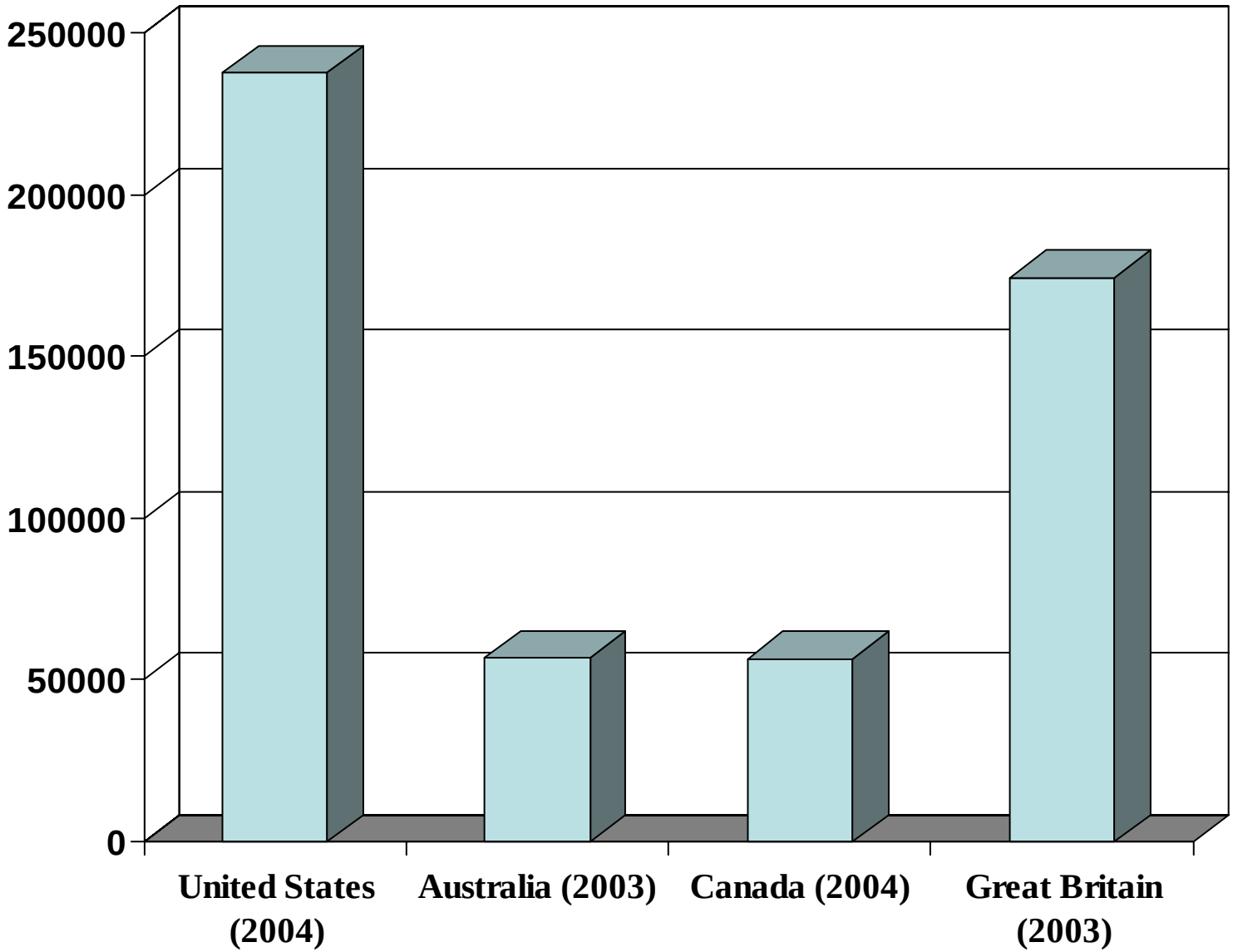


Table 1
Top Ten Sending Countries of US Foreign Students, by Measure

Student Visas Issued, 2003 (Sate Department)[a]		Number of Foreign Students, 2006 (SEVIS)	
Country	Number	Country	Number
Korea	34,697	Korea	86,626
Japan	25,962	India	77,220
India	20,230	China	59,343
China	19,251	Japan	54,816
Taiwan	12,071	Taiwan	36,091
Mexico	9,077	Canada	32,153
Brazil	7,625	Mexico	14,863
Turkey	5,592	Turkey	12,795
Germany	5,376	Thailand	10,940
UK	5,076	Indonesia	8,610

a. Canadian citizens who become US students are not required to obtain a US visa.

To understand the net flow of skill from low- to high-income countries, we need thus to know:

a. Where permanent immigrants in receiving countries are schooled.

b. What determines the gross outflows of those already skilled.

c. Where "stayers" in sending countries are schooled - how many were formerly foreign students ?

d. What determines the outflow of students studying abroad -

low school quality? Job prospects abroad?

e. How permanent are the foreign-born skilled and foreign students.

f. What determines the return of those acquiring their skills abroad (foreign students) and those who left with already-acquired skills ("permanent immigrants")

A. Where are the highly-educated foreign-born schooled?

1. Some emigrants left permanently as children - received all their higher schooling in destination country

USCIS data (FY 2003): 20% of permanent resident aliens in US came before age 18

For Jamaica: 38% came before age 20

For the Gambia: only 10% came before age 20

Thus, BD overstates the migration of the already skilled, and the bias in the estimates varies by country

Recently, Beine, Docquier and Rapoport (BDR, 2006) re-computed their country-specific "brain drain" estimates to take into account those foreign-born who arrived before age 22 (and could not possibly have completed their tertiary schooling at home)

On average their corrected estimates of the "brain drain" are 68% of the ones published initially, with some as low as 51% those reported in the earlier work.

What are wage differences for comparable workers across countries?

One example: Construction carpenter monthly wage (ILO, 1995)

India: $42 Mexico: $125 Korea: $1113 US: $2299

Problem: carpenters in India or Mexico may have much lower schooling than carpenters in the US, or even Korea

Does not capture gains from migration of a person of a given skill

Per-capita GDP gaps are used in most analyses of the determinants of migration:

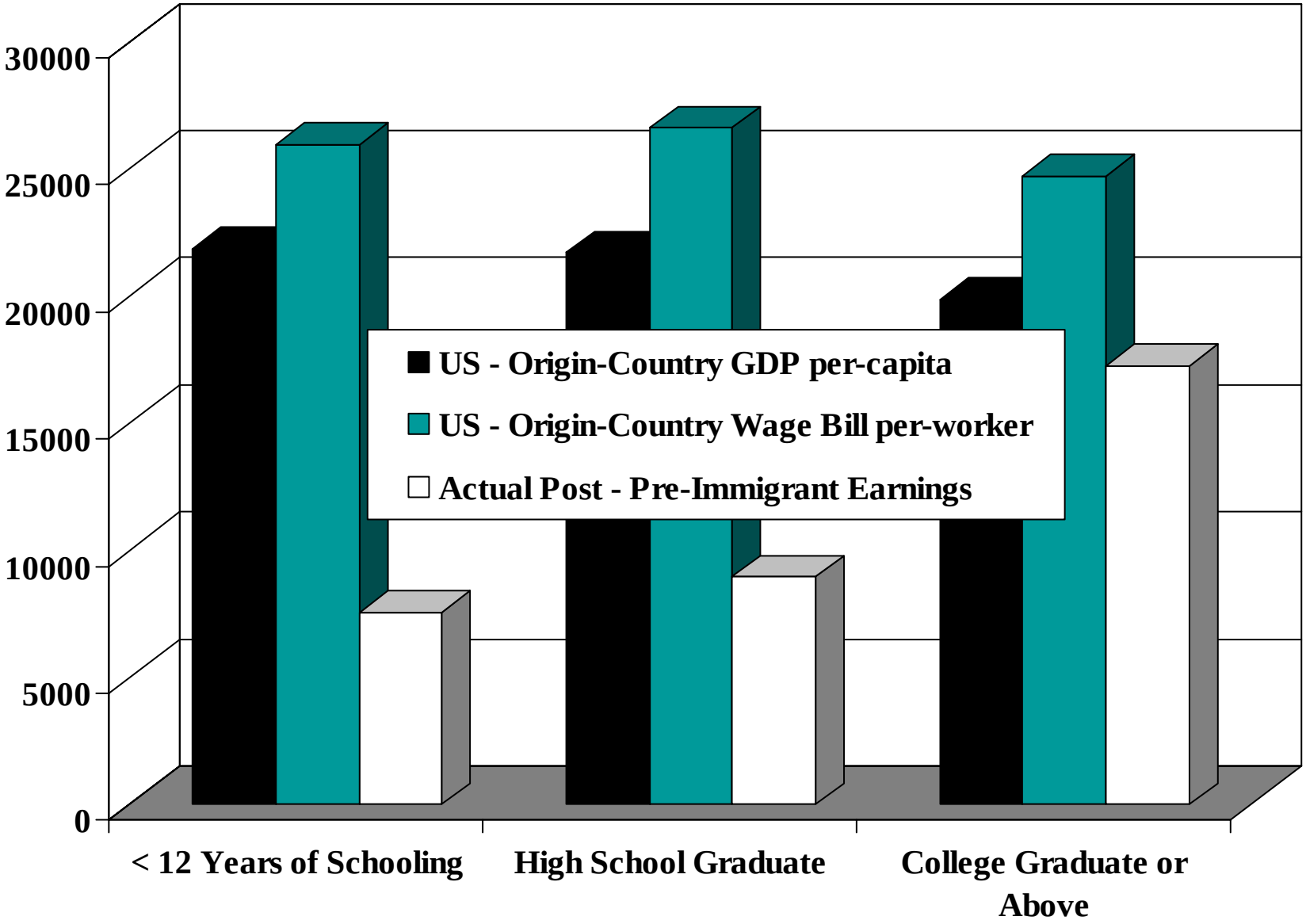
But, cross-country variation is due to differences in the proportion of the population in the labor force and in skill levels, not just rewards to skills

Per-worker GDP also not adequate

Workers vary substantially in skill across countries

Does it matter for measuring migration gains? Yes

Alternative Measures of the Net One-year Benefit from the U.S. Immigration of One Person, by Schooling Level: All U.S Employment and Spouse Immigrants, 1996 (NIS-P)



What determines differences in wages by schooling across countries?

A. Aggregate production technology and resources in each country j

$$Y_j = Y(\mathbf{X}_j, K_{j,} \mathbf{\Phi}_j)$$

where Y_j = aggregate output in country j

$\mathbf{X}_j$ = vector of labor skills in j, K_j = capital, natural resources

$\mathbf{\Phi}_j$ = technology parameters, which may be country-specific

B. Individual skill (human capital) production function (skills and schooling)

$$X_{zij} = S_j^z(S_{ij}, h_{ij}) \qquad z = \text{skill type for individual i}$$

C. Wage function in terms of schooling

$$W_{ij} = W_j(S_{ij})$$

1. Most popular wage function (Mincer wage function). For country j:

$$W(S_i)_j = W(0)_j e^{\beta(j)S(i)}$$

Based on arbitrage model (Adam Smith) and time-discounting:

A. Define lifetime income y for infinite-lived agent with schooling S_i

$$y(S_i) = \int_S W(S_i)_j e^{-r(j)t} dt$$

where r(j) = discount rate in j

assuming y=0 if schooling is being acquired

B. In equilibrium, lifetime incomes for all persons at any schooling level must be equal (arbitrage assumption):

$y(S'_i) = y(S_i)$ for any S, S', including S=0

therefore $\beta_j = r_j$

C. Rejectable predictions of Mincer-Smith model:

1. Differences in "returns to schooling" across countries due *solely* to differences in discount rates = cost of capital

   School quality does not affect the return to schooling

2. Proportionality:

   $$W(S_i)_j / W(S'_i)_j = e^{\beta(S - S')},$$

   as W(0), r must be the same for all schooling levels

In this model of freely mobile human capital within countries,

Knowledge of

$W(0)_j$ (<u>level</u>) and r_j (steepness, or <u>inequality</u>)

is sufficient to describe wage differentials across countries by schooling level

Appendix B: 52-country sample of Mincer regression coefficients

COUNTRY	EXP	EXP^2	S	YEAR	#OBS	REFERENCE
Argentina	.052	-.00070	.107	1989	2965	P
Australia	.064	-.00090	.064	1982	8227	P
Austria	.039	-.00067	.039	1987	229	P
Bolivia	.046	-.00060	.073	1989	3823	P
Botswana	.070	-.00087	.126	1979	492	P
Brazil	.073	-.00100	.154	1989	69773	P
Britain	.091	-.00150	.097	1972	6873	P
Canada	.025	-.00046	.042	1981	4642	P
Chile	.048	-.00050	.121	1989	26823	P
China	.019	-.00000	.045	1985	145	P
Colombia	.059	-.00060	.145	1989	16272	P
Costa Rica	.042	-.00050	.105	1989	6400	P
Cote d'Ivoire	.053	-.00008	.207	1985	1600	P
Cyprus	.092	-.00140	.098	1984	3178	P
Denmark	.033	-.00057	.047	1990	5289	R&S
Dominican Republic	.055	-.00080	.078	1989	436	P
Ecuador	.054	-.00080	.098	1987	5604	P
El Salvador	.041	-.00050	.096	1990	4094	P
Greece	.039	-.00088	.027	1985	124	P
Guatemala	.044	-.00060	.142	1989	8476	P
Honduras	.058	-.00070	.172	1989	6575	P
Hungary	.034	-.00059	.039	1987	775	P
India	.041	-.00050	.062	1981	507	P
Indonesia	.094	-.00100	.170	1981	1564	P
Ireland	.061	-.00100	.079	1987	531	C&R
Israel	.029	-.00046	.057	1979	1132	P
Italy	.010	-.00027	.028	1987	197	P
Jamaica	.083	-.00110	.280	1989	1172	P
Kenya	.044	-.00200	.085	1980	1600	A&S
South Korea	.082	-.00140	.106	1986	4800	P
Malaysia	.013	-.00004	.094	1979	605	P
Mexico	.084	-.00100	.141	1984	3425	P
Morocco	.068	-.00070	.095	1970	2422	P
Netherlands	.035	-.00049	.066	1983	1888	P
Nicaragua	.050	-.00080	.097	1978	962	P
Pakistan	.106	-.00060	.097	1979	1568	P
Panama	.066	-.00080	.126	1989	5436	P
Paraguay	.058	-.00090	.103	1989	1084	P
Peru	.053	-.00070	.085	1990	1625	P
Philippines	.023	-.00060	.119	1988	4283	P
Poland	.021	-.00036	.024	1986	5040	P
Portugal	.025	-.00040	.094	1985	21823	P
Singapore	.062	-.00100	.113	1974	1247	P
Spain	.049	-.00060	.130	1990	635	AR&S
Sweden	.049	-.00000	.026	1981	2996	A
Switzerland	.056	-.00069	.072	1987	304	P
Tanzania	.041	-.00100	.067	1980	1522	A&S
Thailand	.071	-.00088	.091	1971	3151	C
Uruguay	.051	-.00070	.090	1989	6567	P
USA	.032	-.00048	.093	1989	8118	K&P
Venezuela	.031	-.00030	.084	1989	1340	P
West Germany	.045	-.00077	.077	1988	2496	K&P

2. Alternative skill production function (skill price) approach

A. Relax strong assumption of perfect domestic markets for the production of human capital

Development economics literature rife with models, studies highlighting constraints on human capital investments

B. Can utilize information on country aggregates to predict skill *prices* based on aggregate production functions

Relationship between skill prices and output transparent

C. However, must take stand on number of skill types, functional form for production of skill

[Aggregate production technology and the number of skills are irrelevant if there is perfect mobility - Mincer function holds]

What determines the quantity and quality of Migrants? The Skill Price Model

Simplest economic model: one-skill model illustrates main direct effects of migration and is key to understanding the migration of skills across countries

The worker i's wage W_{ij} in home country j is

(1) $$W_{ij} = \omega_j x_i,$$

where

x_i = the skill level of the worker (amount of skill units)

ω_j = the amount each unit of skill is valued in the economy in which the worker is located = the skill price

Variation in wages across workers *within* a country is due to variation in skill levels

Variation in the average wages of workers *across* countries is due to inter-country differences in: (a) average skill levels x_i and (b) skill prices ω_j.

The model has implications for the number and quality (skill composition) of immigrants from and to a country:

The expected initial earnings that worker i in j could earn in destination country u (ignoring for simplicity skill transferability) is given by

(2) $$W_{iu} = \omega_u x_i,$$

where ω_u = the destination-country skill price

The economic gain from migrating from j to u, G_{ij}, for worker i is

(3) $$G_{ij} = x_i[p\omega_{ui} - \omega_j(1+\pi_j)] - C_j.$$

where C_j = direct costs of migrating

$\pi_j W_{ij}$ = time costs of migrating

The utility of residing in destination-country u for a worker born in j is

$$(4) \qquad V^u = \beta_1 \Gamma_{iu} + \beta_2 (W_{iu} - W_{ij}\pi_j - C_{iu}) + \varepsilon^u_i,$$

where Γ_{iu} are amenities from living in u such as a spouse born in u or disamenities associated with a foreign culture and ε^u is a country- and worker-specific error term.

The utility of the worker staying in j is

$$(5) \qquad V^j = \beta_1 \Gamma_{ij} + \beta_2 W_{ij} + \varepsilon^j_i.$$

The decision rule: migrate iff $V^u > V^j$

The model delivers the result that a rise in the home-country skill price reduces the gain from immigration and thus the probability of migration: fewer migrants from low skill price countries.

What about migration selectivity?

1. What is the effect of a rise in the sending-country skill price on the average skill of immigrants?

Example: the marginal distributions of skills in each country are normal (or log normal), the joint stochastic or unmeasured parts of the utility functions (containing the ε^j) are independently and identically Gumbel distributed, and skills and the ε^j are

(6)
$$\partial E(x_i \mid V^u > V^j)/\partial \omega_j =$$
$$\partial E(x_i \mid -\beta_2 W_{iu} - \beta_1(\Gamma_{ij} - \Gamma_{iu}) + \varepsilon^u - \varepsilon^j > -\beta_2(W_{ij} - C_{ij})/\partial \omega_j$$
$$= \beta_2 \sigma^2(x_i) A > 0,$$

where $A = \lambda^2 + \beta_2 W_{ij}\lambda$, $\lambda = \varphi[H(P)]/\Phi[H(P)]$ (the Mills ratio), and H() is the inverse standard normal cumulative density function evaluated at the probability P that the worker chooses to migrate.

More skilled workers will come from higher skill-price countries

2. What is the effect of a rise in moving costs on the average skill of immigrants?

(7) $\partial E(x_i \mid V^u > V^j)/ \partial C_j = (\omega_u x_i^{\delta iu-1} - \omega_i)\sigma^2(\mu_i)[\lambda^2 + \beta_2 C_{ij}\lambda] > 0.$

More skilled workers will come from more distant countries, if distance and migration costs are positively correlated

Distance is not the only cost of migration, and the cost of migration may be related to many things:

A. Ability to finance migration: credit availability, wealth

B. Search costs: having community members in the receiving country may lower migration costs (networking)

Thus, more networked workers may be less positively selected

Education may be correlated with migration costs

What determines the acquisition of schooling abroad?

The skill production model facilitates modeling the decision to where to acquire schooling, as it incorporates the quality of schooling directly

Consider now the choice of schooling location for a student i residing in country j.

Schooling taken abroad has two potential benefits:

A. Foreign schooling may enhance the prospects for receiving a job abroad (at a higher skill price).

B. Schools abroad may be of higher quality, so that the foreign-trained student will earn more at home for the same schooling cost than if she acquires the schooling domestically.

Let p^A = the probability of getting a job in the destination country u where schooling is taken

α = the quality of schools abroad,

Then, the expected wage if one unit of schooling is taken abroad is given by

$$E(W_{ij})^A = p^A \omega_u e^{\alpha} + (1 - p^A)\omega_j e^{\gamma\alpha},$$

where γ ($0<\gamma<1$) measures the extent to which schooling acquired abroad is of less value in the home country than in the destination country.

The expected gain from schooling abroad G^A is then

$$G_{ij}{}^A = p^A \omega_u e^{\alpha} + \omega_j[(1 - p^A)e^{\gamma\alpha} - e^{\beta}] - C_{ij}{}^A,$$

where C^A = direct cost of acquiring schooling outside the country; e.g., travel costs, foreign language training, and the extra tuition.

Note that (4) assumes that the probability of obtaining a permanent job abroad if schooling is acquired domestically is nil, while the probability of obtaining a job abroad is not insignificant (of, course, just need a non-trivial inequality).

What is p^A? We show below = 20%

What is the probability of getting a job, say, in the US without US schooling for a typical person residing outside the United States??

Probability of having a relative abroad?	Infinitesimal
Probability of winning the diversity lottery =	½ of 1% (0 for China, India, Pakistan, the Philippines, South Korea, Vietnam)

The student model delivers the same implication of the model describing the migration choice of those with given skills:

inter-country skill price differences attract students

Assume that

A. Students will acquire schooling abroad if $G_{ij}^{A} > 0$

B. Choose host country with highest G_{ij}^{A}.

Implications - skill price gaps:

1. The lower the domestic price of skill, the higher the gain from acquiring schooling abroad, if P^{A} is high and schooling returns not too different:

$$\partial G^{A}/\partial \omega_{j} = (1 - p^{A})e^{\gamma\alpha} - e^{\beta} \quad = \quad - p^{A}e^{\beta} < 0 \quad \text{if } \gamma\alpha \approx \beta$$

2. The higher the foreign price of skill, the higher the gain from acquiring schooling abroad:

$$\partial G^{A}/\partial \omega_{u} = p^{A}e^{\alpha} > 0.$$

School quality difference matter also:

1. The higher the quality of domestic schools, the lower the gain from foreign schooling:

$$\partial G^A/\partial \beta = - \omega_j e^{\beta} < 0.$$

2. The higher the quality of foreign schools, the higher the gain from foreign schooling:

$$\partial G^A/\partial \alpha = p^A \omega_u e^{\alpha} + \gamma \omega_j (1 - p^A) e^{\gamma \alpha} > 0.$$

3. The higher the direct costs of acquiring schooling abroad, the lower the gain:

$$\partial G^A/\partial C_{ij}^{\ A} = -1.$$

Then, if there is a domestic distribution of individual costs of acquiring schooling abroad or abilities to finance the costs, then the higher the average gain, the higher the proportion of students who will acquire schooling abroad

Identifying Skill Prices

How do we know what skill prices are around the world?

Given absence of comparable data on country-specific wages, almost all studies use per-capita GDP as the principal determinant of migration

Seen GDP differences do not measure migration gains, by skill, well

But, the framework suggests that variations in the skill price and GDP per-capita can have opposite effects on migration -

A rise in the skill price at home lowers the gain from migration, for given direct migration costs

For a given skill price, higher per-capita GDP may facilitate financing of the direct costs of migration.

What is the relationship between GDP and skill prices?

Assume aggregate output Y_j in country j is produced according to Cobb-Douglas technology (one skill):

(4) $$Y_j = AL_j^{\alpha} \Pi K_{nj}^{\gamma},$$

where the K_{nj} = country j's stock of non-labor resources (e.g., land, capital, minerals)

L_j = country j's aggregate stock of labor in skill, given by

(5) $$L_j = N_j(a(x_{ij})),$$

where N_j = the total number of workers in j and a() is an inverse function yielding the average skill units per worker in country j in terms of observables.

The skill price ω_j is the marginal product of an efficiency unit of labor, given by

(6) $$\omega_j = \alpha Y_j / N_j(a(x_{ij}))$$

Thus,

(7) $$Ln(\omega_j) = Ln\alpha + Ln(Y_j/N_j) - Ln(a(x_{ij}))$$

(7) implies that aggregate output *per worker* is positively and average skill levels are negatively correlated with skill prices across countries

Data for each country of the world needed to predict skill prices:

output per-worker, measure of schooling of work force (if know $(a(x_{ij}))$

Provides a predicting equation for skill prices, but still need to obtain the ω_j's

Estimation of skill prices from micro data on wages "around the world":

Assume the number of skill units of a worker is a function of schooling, other human capital variables and an unobservable skill endowment; for example:

(8) $$x_{ij} = \mu_{ij}\exp(\beta_j S_{ij} + \mathbf{I_{ijk}}\boldsymbol{\gamma}_k),$$

where S_{ij} = schooling, β_j = country-specific schooling "return", μ_{ij} = skill endowment

$\mathbf{I_{ijk}}$ = vector of other human capital variables for worker i in country j

$\boldsymbol{\gamma}_\mathbf{k}$ = a vector of coefficients

Then the log of worker i's wage in country j, from (1), is

(9) $$\mathrm{Ln}(W_{ij}) = \mathrm{Ln}\omega_j + \beta_j S_{ij} + \mathbf{I_{ijk}}\boldsymbol{\gamma}_\mathbf{k} + \mathrm{Ln}\mu_{ij}.$$

The intercepts in (9), which are allowed to differ across countries, provide the log of the skill price for each country represented in the data.

Note: equation (9) is the same as the Mincer earnings function,

$$\text{with } Ln\omega_j = Ln(W(0)_j) \text{ and } \beta_j = r_j$$

We can test the Mincer-Smith model (perfect skill markets):

Do measures of school quality in addition to time in school affect wages?

Mincer-Smith: only time in school matters for equilibrium wages

School quality only affects the aggregate amount of investments in schooling

Modify the skill production function to allow direct effects of school quality (Q) on wages (quality = production of more skill per unit of time):

$$x_{ij} = \mu_{ij}\exp(\beta_j S_{ij} + \mathbf{I_{ijk}}\boldsymbol{\gamma}_k),$$

where, say, $\beta_j = \beta_1 + \beta_2 Q_j$

H_0: $\beta_2 = 0$, as implied by Mincer-Smith

Up to now we have used a one-skill model.

What if there are multiple skills?

If Mincer-Smith model is correct, it does not matter for describing the wage gaps that motivate migration:

just need to know $W(0)_j$ and β_j:

The wage-schooling relationship holds in equilibrium no matter how many different types of skills

With multiple skills, there is a skill price ω_{jz} for each skill type z

If the Mincer arbitrage assumption does not hold, then the log of worker i's wage in country j of skill type z, from (1), is

$$(9) \qquad Ln(W_{ijz}) = Ln\omega_{jz} + \beta_{jz}S_{ij} + \mathbf{I_{ijk}\gamma_{kz}} + Ln\mu_{ijz}.$$

If there are, say, two skill types (z=1 and 2), and the production, from (4) is:

(4) $$Y_j = AL_{j1}^{\alpha 1} L_{j2}^{\alpha 2} \Pi K_{nj}^{\gamma},$$

and the log of the skill-specific skill price is given by

(7) $$Ln(\omega_{jz}) = Ln\alpha_z + Ln(Y_j/N_{jz}) - Ln(a(x_{ijz})), \qquad z = 1,2$$

To *predict* skill-specific prices for countries of the world, we additionally need:

A. Number of workers by skill type

B. Schooling of workers for each skill type

These data are available for fewer countries

Data for Estimating World Skill Prices

What are the micro data that can be used to estimate wages, by schooling, for countries of the world?

Requires comparable information on the earnings of workers of the same skill across all countries of the world to assess migration and wage-determination models

There are three sources:

A. The New Immigrant Survey Pilot (1996)

B. Occupational Wages Around the World (2000)

C. The New Immigrant Survey (2003)

A. ***New Immigrant Survey-Pilot (NIS-P), 1996***: provides earnings of new US immigrants in their last job in their home country

Advantages:

1. Information obtained from common questionnaire

2. Information obtained on worker's schooling, age, experience

Disadvantages:

1. Selective sample: model implies immigrants positively selected on unobservables

2. Sample size: 332 workers for 54 countries

B. ***Occupational Wages Around the World (OWW),*** Freeman and Oostendorp: provides monthly earnings (estimated) for workers by occupation and industry

Advantages:

1. Large sample size: 4942 observations in a single year (1995)

2. Meant to be non-selective

Disadvantages:

1. Information not necessarily comparable across countries

2. Number of countries represented is small in any one year: 67

3. No information on the education or age of workers (see carpenters!)

C. ***New Immigrant Survey (NIS), 2003 Baseline***: provides earnings of new US immigrants in their last job in their home country

Advantages:

1. Information obtained from common questionnaire

2. Information obtained on worker's schooling, age, experience, and occupation

3. Sample size: over 4000 workers for 140 countries

Disadvantages:

1. Still incomplete and selective sample of countries: only those with sufficient number of immigrants in US

2. Selective sample of workers: those workers who chose to emigrate (model implies immigrants positively selected on unobservables)

Table 2
Characteristics of Global Earnings Data Sets

Data set/variable	NIS-P Home-Country Workers	OWW, 1995	NIS Home-Country Workers
Mean annualized earnings of respondents (US$)	14719[a] (2602)	10208[b] (13289)	17803[a] (29410)
Mean age of respondents	34.6 (8.53)	-	39.7 (11.5)
Mean years of schooling of respondents	14.4 (4.5)	-	13.8 (3.82)
Number of industries	-	49	-
Number of occupations	-	161	-
Number of countries	54	67	140
Number of workers	332	4924	4455

a. PPP-adjusted
b. Exchange rate adjusted, country-specific calibration with lexicographic imputation

Estimation strategy for identifying skill prices and their effects on migration

1. Estimate wage equation (9) for all workers in the NIS-P or NIS, based on earnings in last job before coming to the United States - home country wages.

Allow β to vary across countries:

a. Non-parametrically: individual dummy interactions

$\beta_j = \Sigma\delta_j S_{ij}$, where the δ_j are country dummy variables

b. As a function of measures of quality Q_j of schooling: (Mincer test)

$\beta_j = f(Q_j$ for primary, secondary and tertiary schools)

Measures: teacher-pupil ratios for primary and secondary schools (Barro-Lee)

World ranking of universities - any ranked, mean rank (top 200): *Times Higher Education*

Table 4
FE-Country Log Wage Regression Coefficients:
Log Hourly Wage at the Last Job Before Coming to the United States (Mincer Test)

Sample	All Immigrants		College Grad	No College
Origin-country variable	(1)	(2)	(3)	(4)
Years of schooling completed	.0968 (12.04)	.0882 (7.79)	.0250 (0.22)	.0533 (0.98)
Years of schooling*any ranked universities in country	--	.149 (2.19)	.448 (1.97)	.0396 (0.27)
Years of schooling*mean rank of universities in country	--	-.00127 (1.98)	-.00428 (2.20)	-.00026 (0.19)
Age at last job	.123 (7.10	.125 (7.21)	.0717 (2.71)	.0459 (1.84)
Age at last job squared	-.00142 (7.00)	-.00144 (7.08)	-.0010 (3.06)	-.00065 (2.27)
R^2	.222	.223	.224	.244
Number of workers	3,364	3,364	1,605	1,739
Number of sending countries	131	131	116	114

Estimates of Skill Prices Using the NIS

1. Skill prices or $W(0)_j$ differ significantly across countries

2. Rejection of Mincer-Smith equilibrium:

    A. Quality matters (not spurious) B. Non-proportional wage differences

Figure displays the estimated (PPP-adjusted) skill prices for 19 Asian countries, based on the NIS-P and OWW data sources (correlation = .66)

See differences in skill prices are enormous, however estimated:

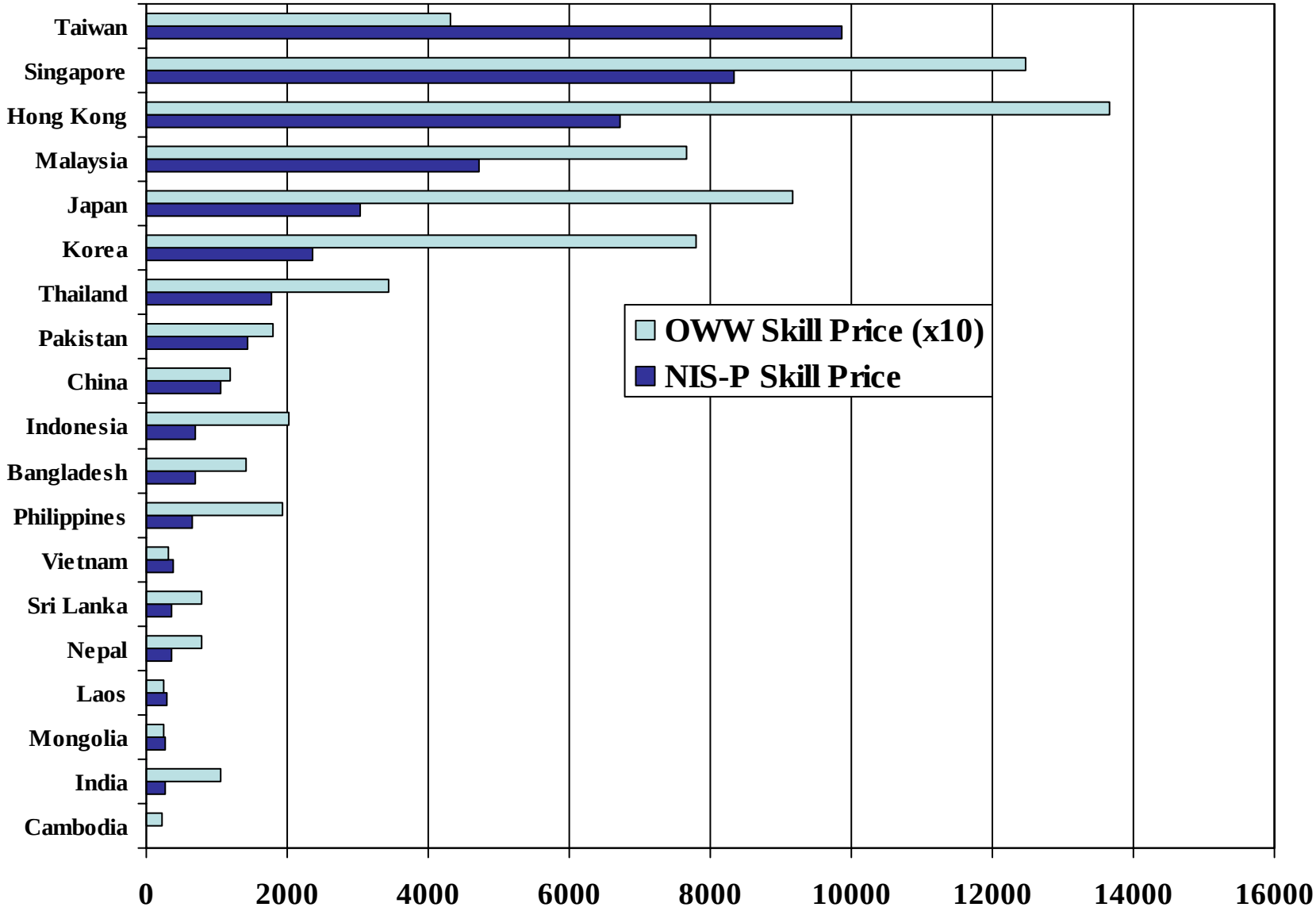
Skill price in S. Korea is 3.5 to 5.5 times that in Bangladesh

How do skill prices relate to earnings by educational level across countries?

Compute for selected countries earnings for high-school and college graduates using skill price estimates

Assume rate of return to schooling is .07 (β) for all countries.

Estimated PPP $ (1995) Skill Prices for 19 Asian Countries, by NIS-P and OWW Sources



Estimated (Purchasing-Power Adjusted 1996) Earnings of High School and College Graduates, Across Selected Countries Around the World (r=.07)

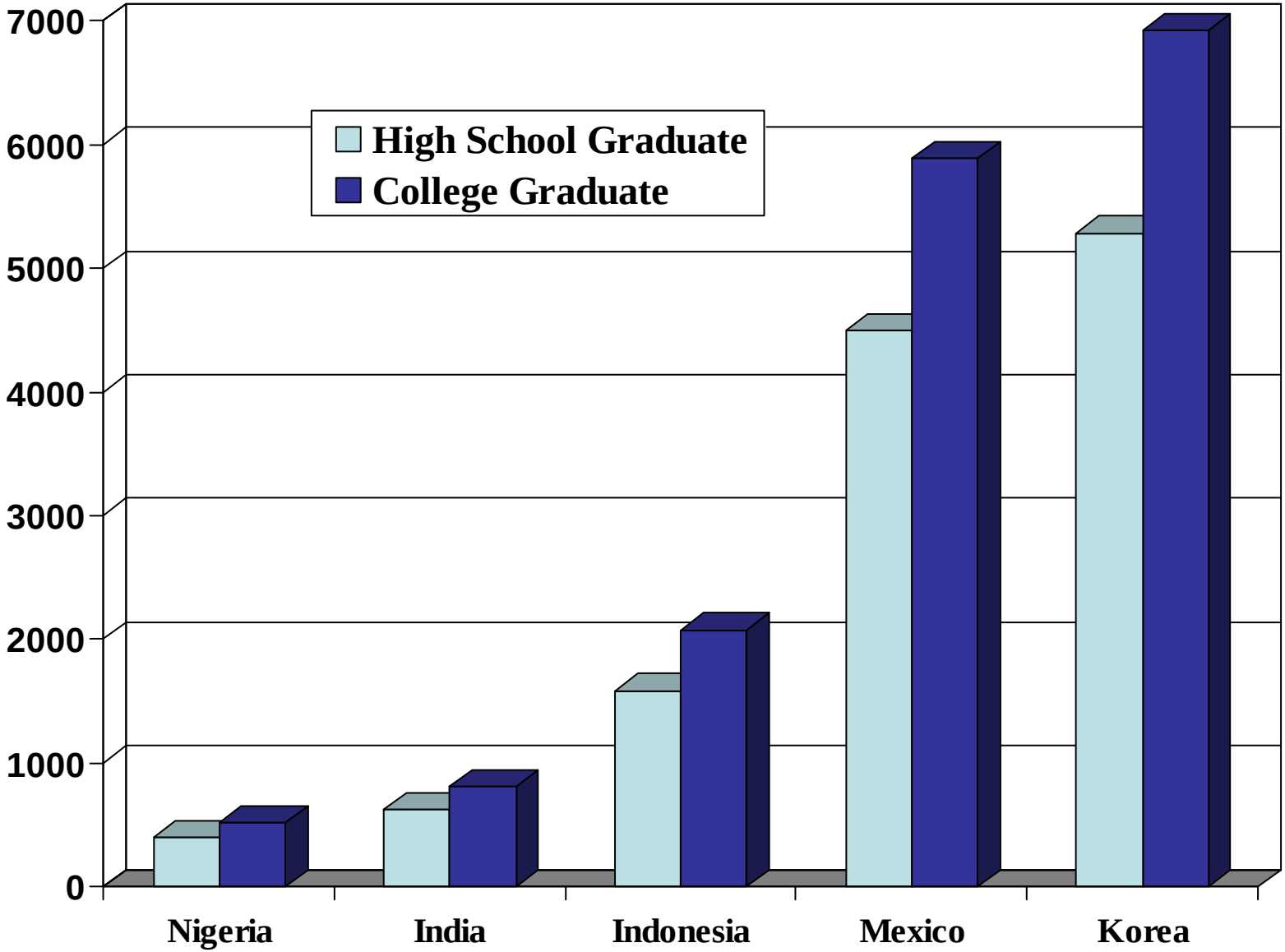


Figure shows estimated (PPP-adjusted) earnings by schooling level for six countries

Two important features:

A. Gains from moving across countries always greater for those with more skill

B. Equalizing schooling levels across countries (say, making everyone a college graduate) would change global earnings inequality very little

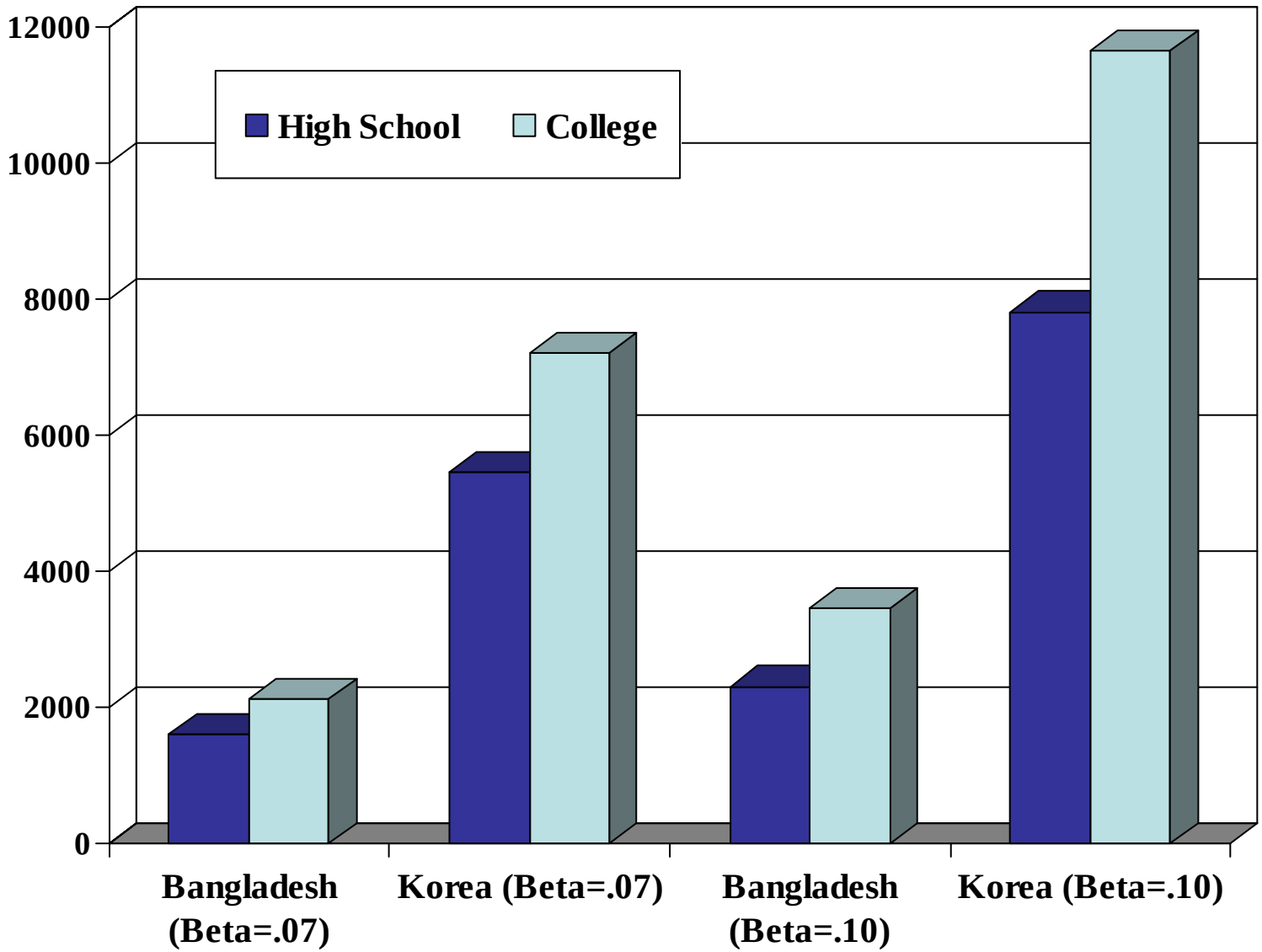
Inequality across countries dominated by difference in rewards to skills across countries

What is the effect of home-country relative "inequality" on the skill selectivity of immigration?

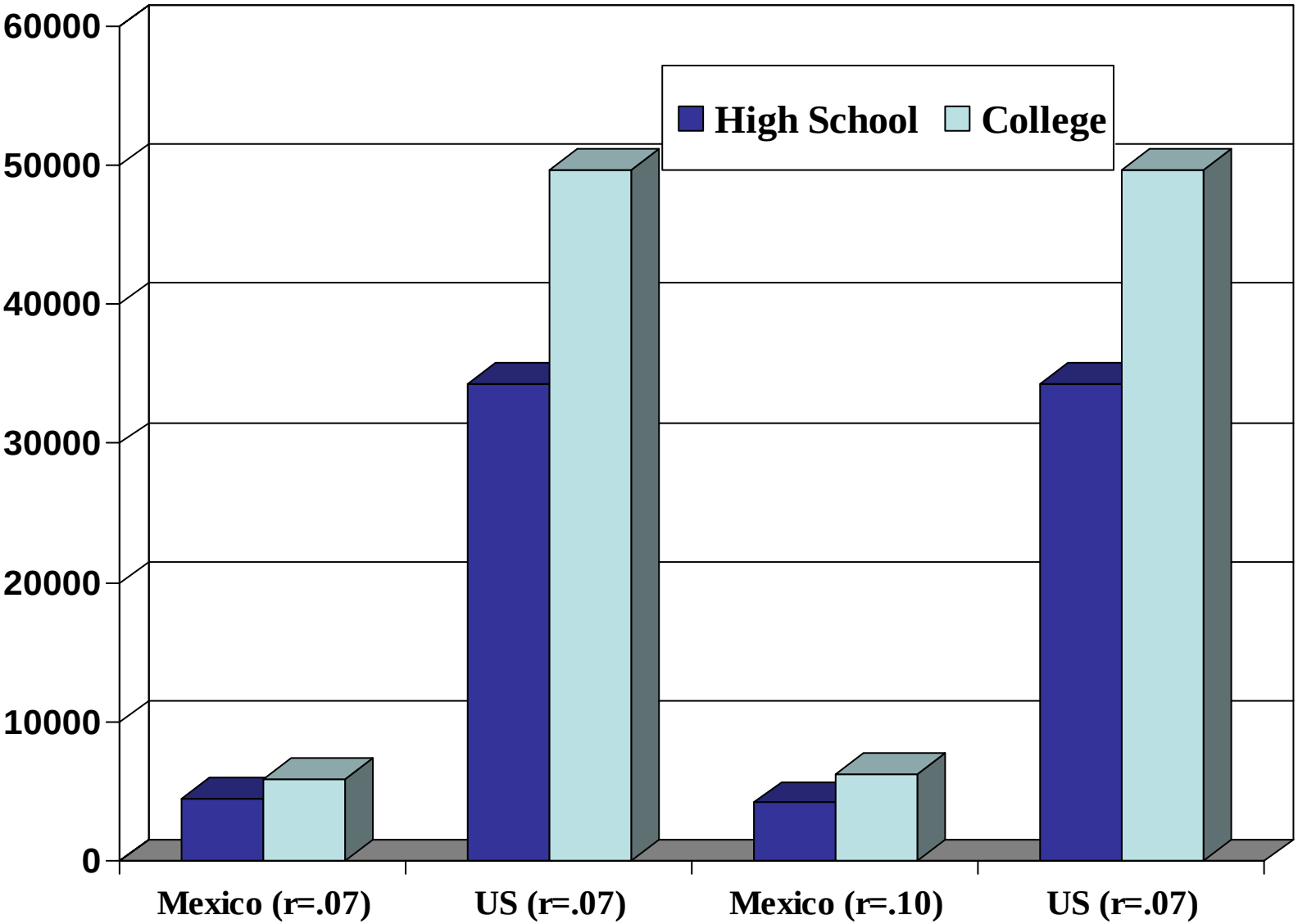
In the one-skill or Mincer model, higher inequality due to higher "return" to schooling β or r

How does a rise in β or r in the sending country affect the differential gain of, say, high school and college graduates?

PPP-Adjusted 1996 Estimated Annual Earnings (NIS-P Skill Prices) in Bangladesh and Korea, By Schooling Level and Schooling Return



PPP-Adjusted 1996 Estimated Annual Earnings in Mexico and the United States, By Schooling Level and Schooling Return



Estimates: Determinants of Immigration and Skill Prices and Selectivity Test

1. Probit estimates of the determinants of sample inclusion

    Proximity matters (identification), in addition to determinants of skill prices, which exhibit coefficients as expected

2. Predicting equation for skill prices for the three data sets

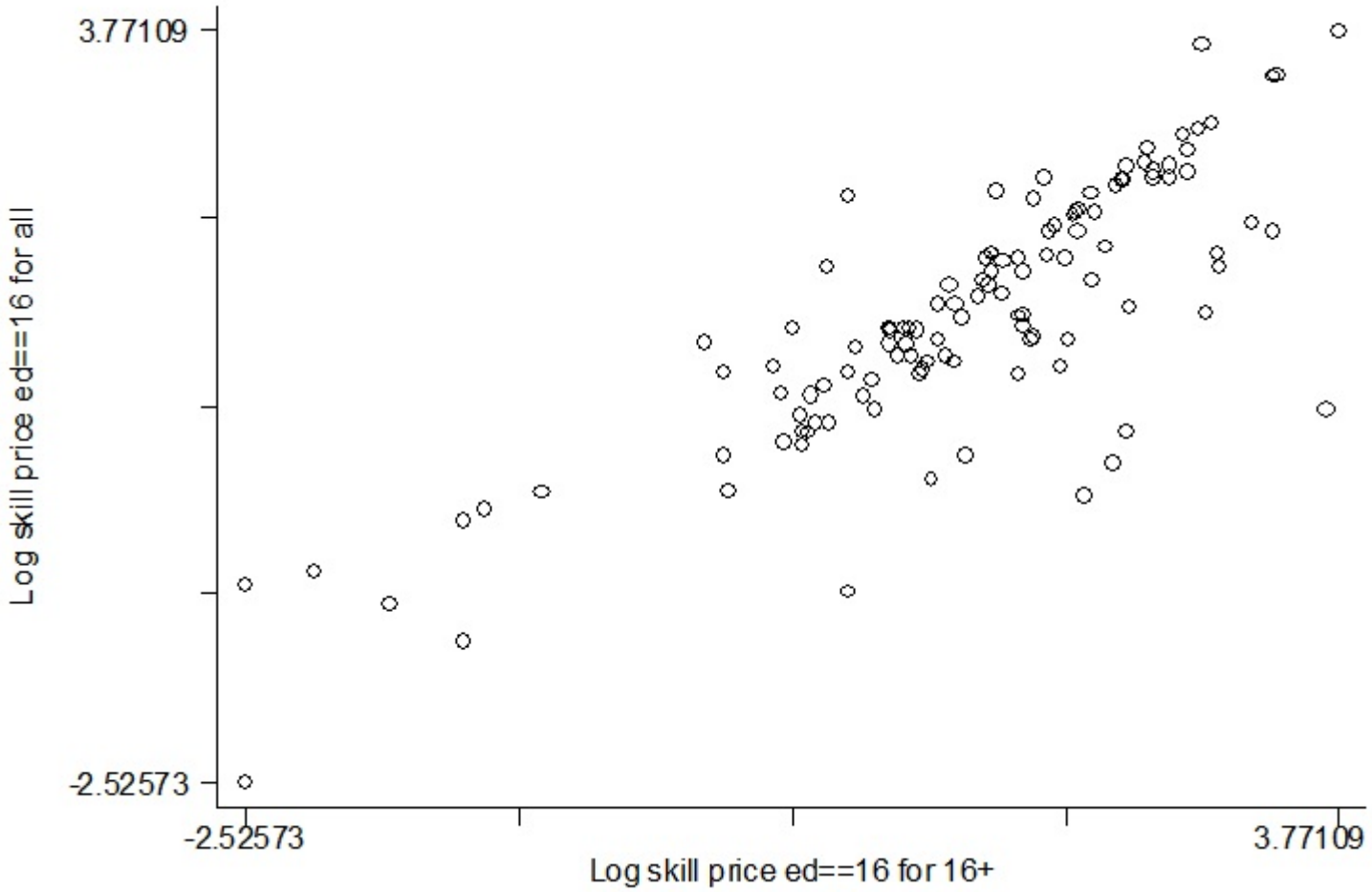
    Signs of relationships as expected:

        1. Positively related to output per worker

        2. Negatively to aggregate quantity and quality of schooling in the labor force

    But no evidence of selectivity

Relationship Between Log Skill Price (One Skill) and Log College+ Skill Price



How do skill prices and migration costs affect the amount and average skill of immigrants?

Obtain MI estimates of determinants of number of US "permanent" immigrants (from the labor force): across 168 countries, for two types

A. All immigrants B. Employment visa principals

Findings: 1. Less immigrants from higher skill price countries

2. Per-capita GDP, given the skill price, has a positive effect on out-migration

Suggests importance of credit constraints

3. Proximity to the United States matters, given income and wage gains: fewer immigrants from countries located farther away

MI estimates of determinants of average schooling of immigrants

A. Employment visa principals B. EVP +spouses C. All immigrants

Findings mirror image of quantity estimates, as expected, but only for A and B:

Higher skill prices increase average quality of those who leave

Higher per-capita GDP or proximity lowers *average* quality

Do lower skill price countries send out more or less *total* human capital?

What is the elasticity of N*average S with respect to skill price?

-.827 + .499 = -.328

But development effects are complex, total elasticity of per-capita GDP is

.346 - .108 = .238

Determinants of Student Outflows: Where do US Foreign Students Come from?

A. As seen, the United States is the major host country in the world for students

Why? [jobs and number of universities]

B. Exploit unique information on students and immigrants permitting estimation of return rates

Additional source of data:

Counts of students by country in 2005: US SEVIS

Essentially same specification as for immigrants, except add the number of universities by country in addition to the quality measures

Estimates for Numbers of US Foreign Students

1. Skill price coefficients are consistent with the hypothesis that student study abroad is motivated by gains from permanent migration

   More students per-capita from lower skill price countries

   Doubling of skill price (ex: India to Philippines): reduces stock of students by 26%-73%

2. Costs of schooling matter

   For given skill price, higher per-capita income leads to more foreign schooling (82% of undergraduate schooling self-financed by foregn students; 43% for graduate students)

   Doubling both a country's skill price *and* income increases study abroad

   Greater distance to the United States reduces foreign student flows

3. Effects of Domestic Investments in tertiary education:

Increasing the average quality of tertiary education *decreases* student outflows

Increasing the number of universities *increases* student outflows (grad. Ed)

How Many Foreign Students (do not) Return?
Determinants of the Return Rates of US Foreign Students

The number of foreign students R_j who return to their home country j:

$$R_j = (1 - r_j)m_j,$$

where r_j = the fraction of students from j who remain in the host country

m_j = the stock of students from j in the host country

How do we compute r_j?

Need to know the number of permanent immigrants who were once foreign students

The NIS provides complete history of "visits" to the US, and all prior visas held

Student stayers = New permanent immigrants who once held a student visas

6% of all new immigrants

Who are they?

A. Highly educated, particularly those from Asia, compared with other new immigrants

B. Scientists, engineers, particularly from Asia, compared with other immigrants

Highly trained, technical elite are being lost - but what fraction return?

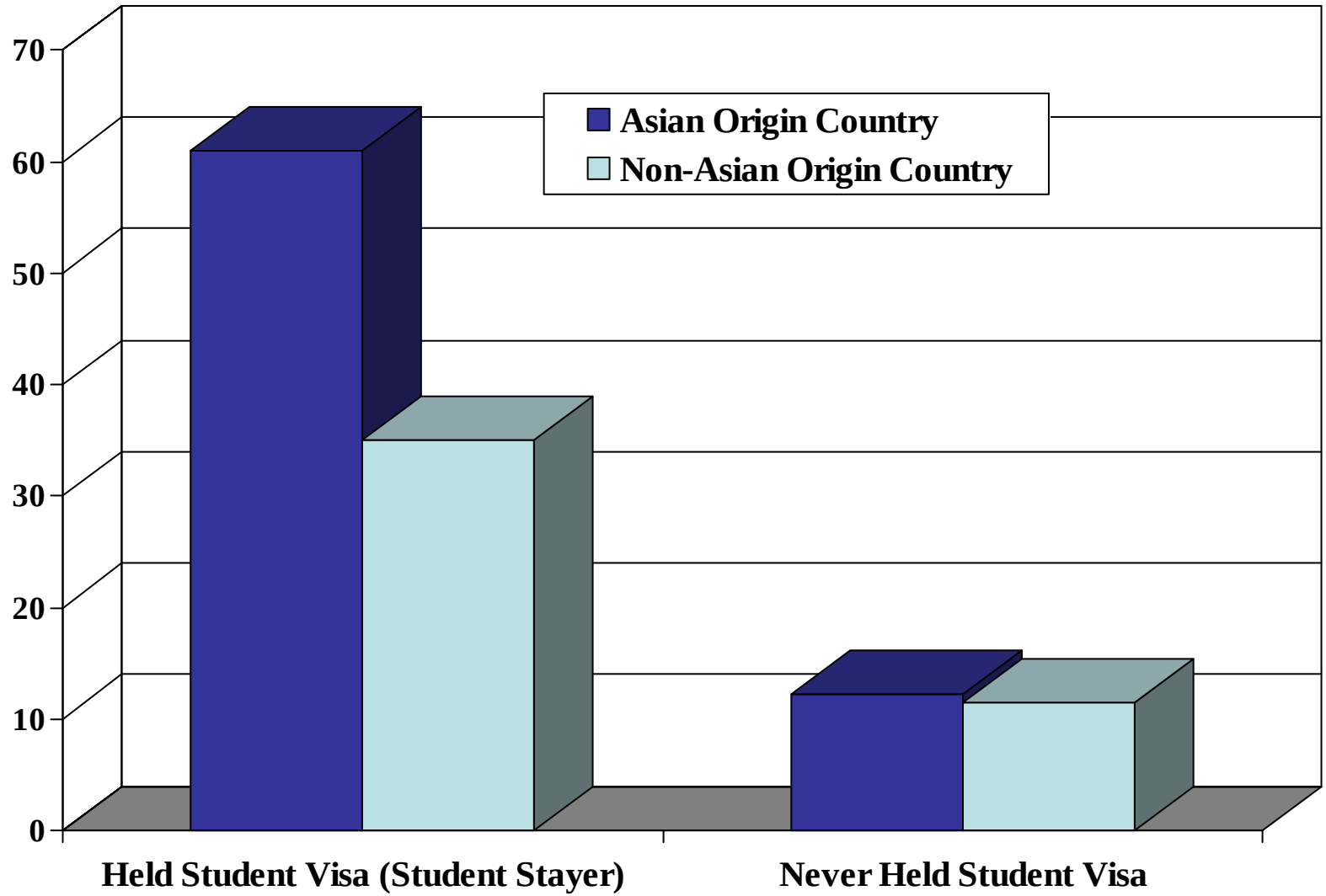
Compute for each sending country j the stay or depreciation rate r_j =

Number of student stayers from j / Stock of students from j

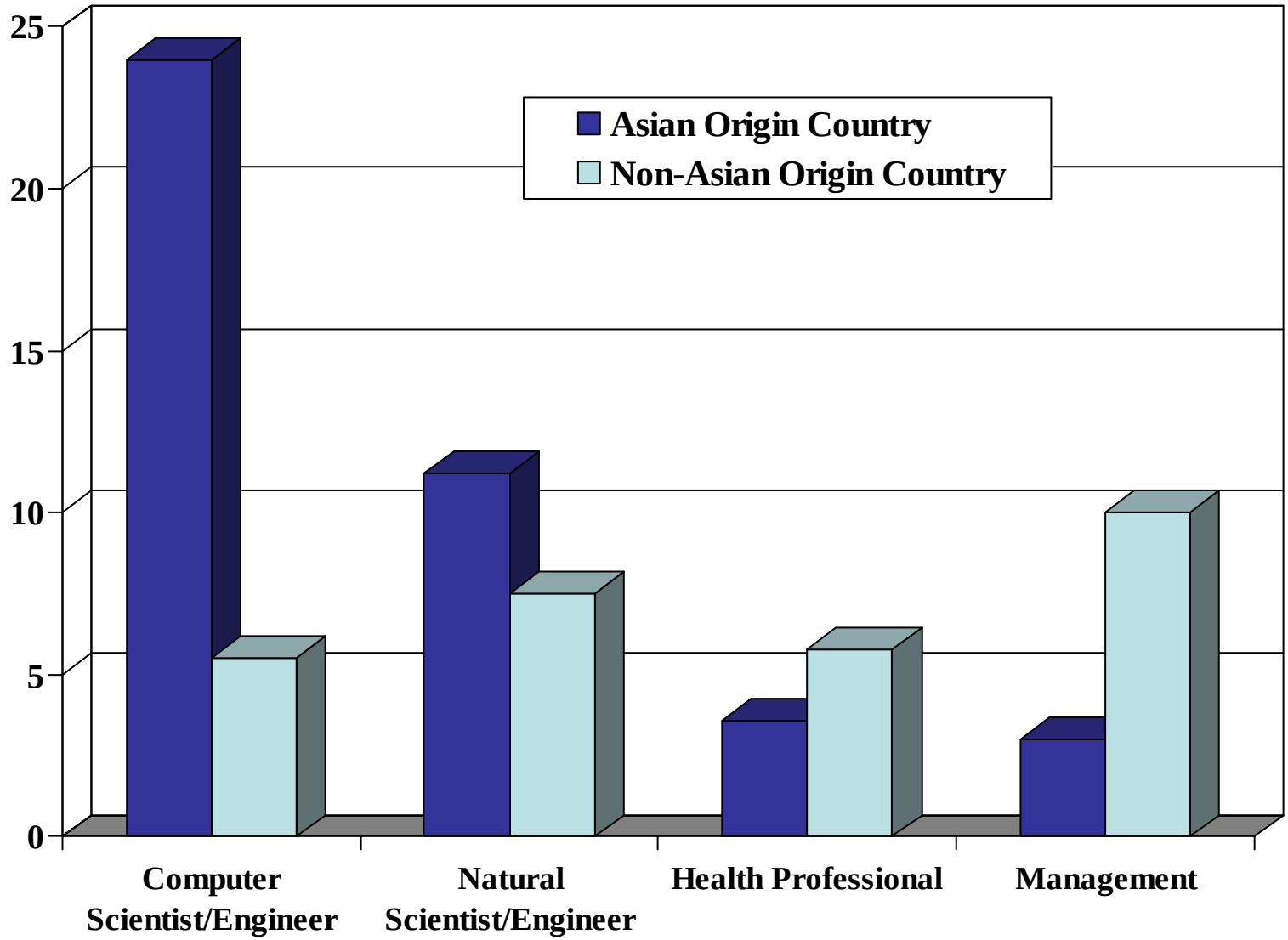
Average stay or depreciation rate of the stock = 4.7% (2.7% for Asia-origin)

If about 5 cohorts in the stock, that is a flow return rate of about 20%

Percentage of New US Permanent Immigrants in 2003 with Post-Graduate Training, Student Stayers and All Other Immigrants, by Origin Region



Occupational Distribution of Student Stayers:
New US Permanent Immigrants in 2003 Who Had Held a Student Visa, by Origin Region



The estimated stay rates r_j vary widely across Asian countries

Figure displays the rates for 19 Asian countries

Stay rates are highest for Cambodia, Burma the Philippines

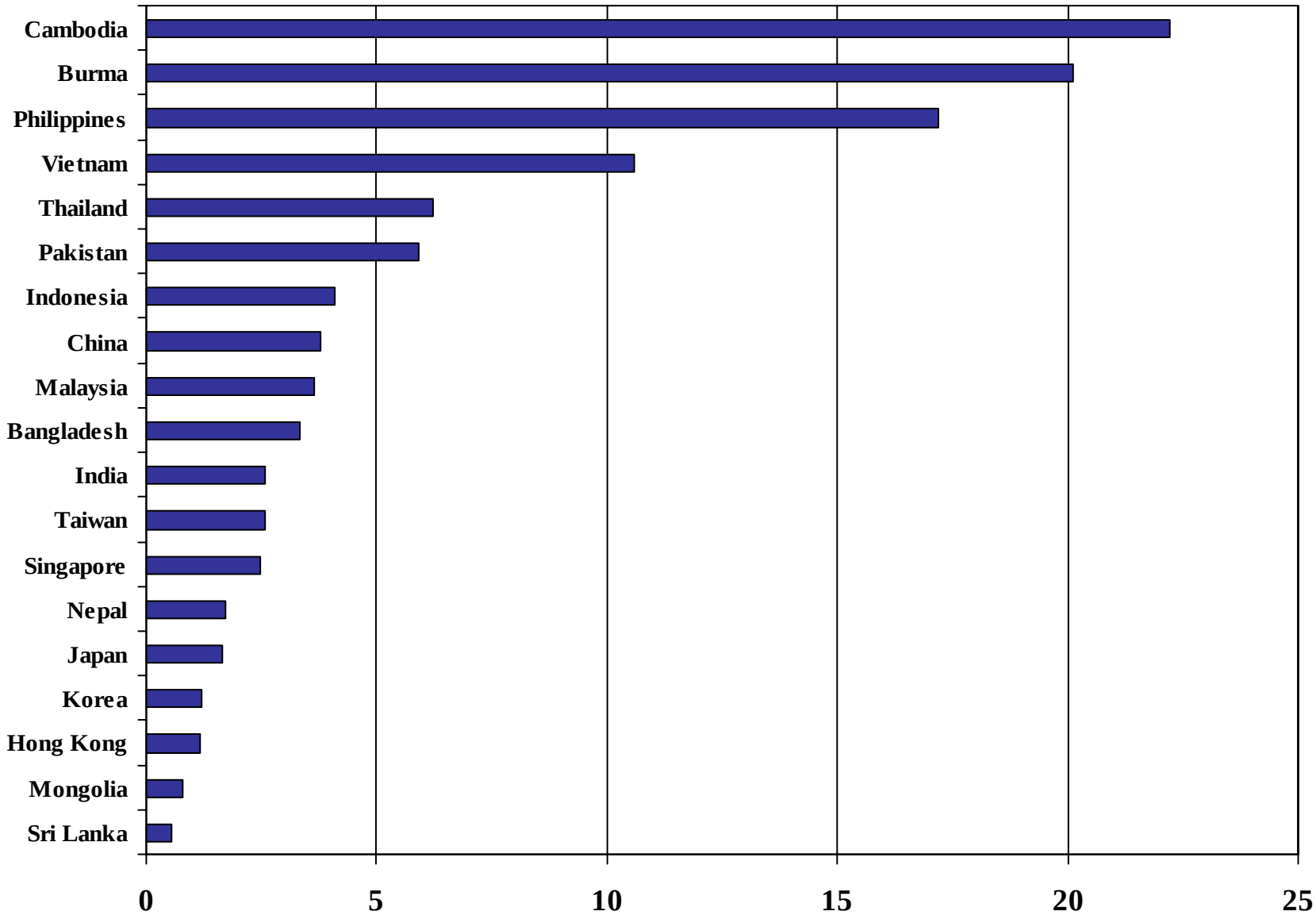
But what determines variation?

Table presents estimates of how country-of-origin characteristics affect the return rates across all countries

Hypothesis: higher return rates to countries with higher skill prices

Confirmed

Estimated Annual Student "Depreciation" Rates for 19 Asian Countries



Now, we know:

1. How skill prices at home affect the numbers of students who go abroad

2. How skill prices at home affect the rates at which students return

How do skill prices on net affect the number of returned foreign-trained students:

$$d\log R_j / d\log \omega_j = \eta_m + \eta_{(1-r)},$$

where η_m = the estimated skill price coefficient in Table 2 for the country's stock of students obtaining training in the United States

$\eta_{(1-r)}$ = the estimate of the effect of log skill price on the log return rate

The combined estimates are -.24 (NIS-P) and -.71(OWW)

Thus, lower skill price countries have larger stocks of foreign-trained students

But that it is not quite the end of the story:

Not all “permanent” immigrants stay forever

What are the magnitudes of return migration by skilled immigrants who have acquired significant skills in the receiving country and who were not required to return home?

Few estimates for “permanent” immigrants

Jasso and Rosenzweig (1982) combined INS administrative records at entry for the FY 1971 cohort of legal permanent immigrants with their subsequent naturalization and address report records to estimate 10-year emigration rates:

Overall proportion who left = 30%

As high as 50% in some countries

NIS question to new ("permanent") immigrants, entitled to remain in the US the rest of their lives, soon after obtaining their visas:

"Do you intend to live in the United States for the rest of your life?"

Figure reports the fractions reporting "No" or "Not sure" for

A. Students stayers

B. Employment immigrants

Fractions not inconsistent with prior estimates

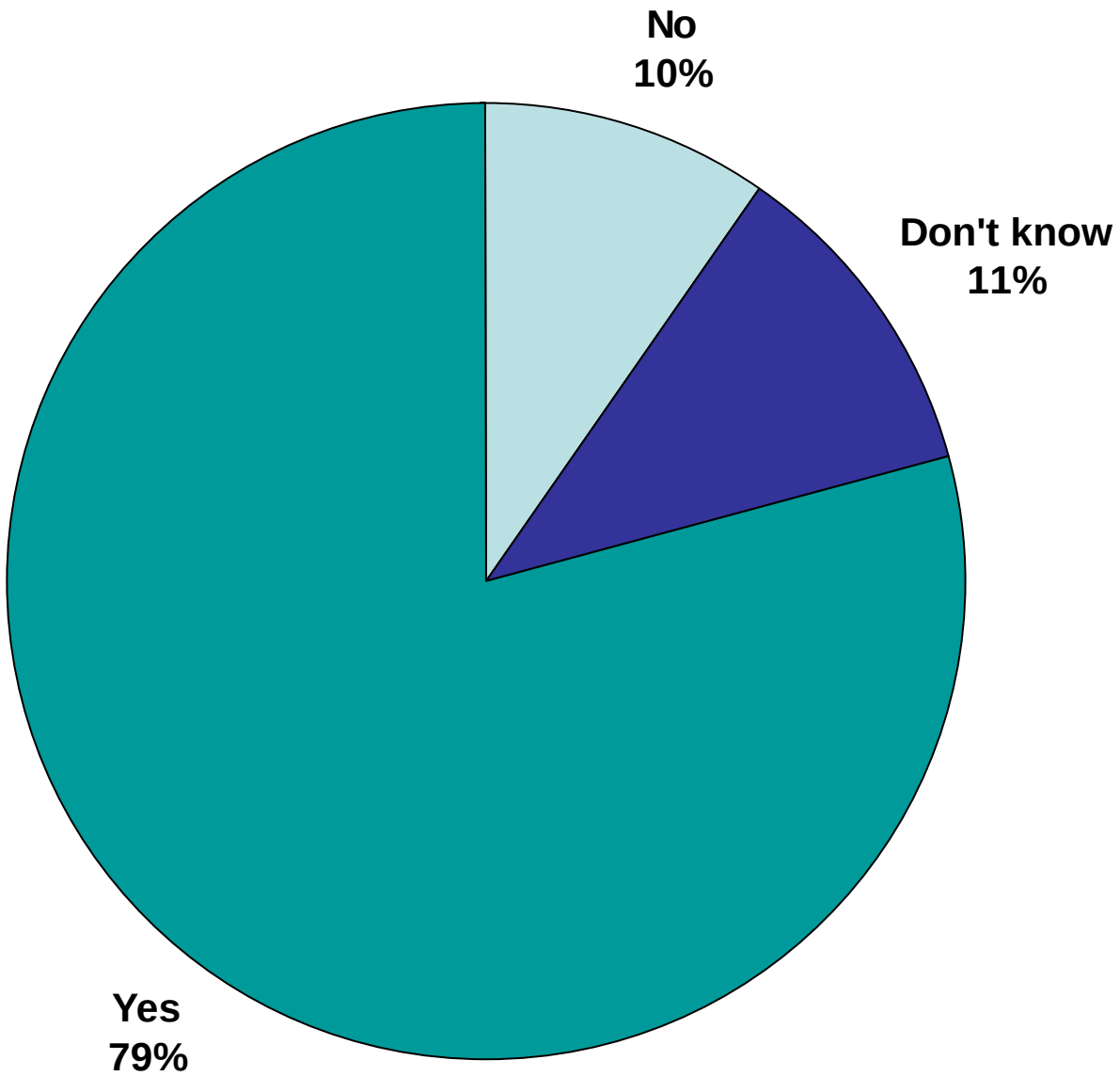
Final questions:

What are the determinants of "intentions" to return?

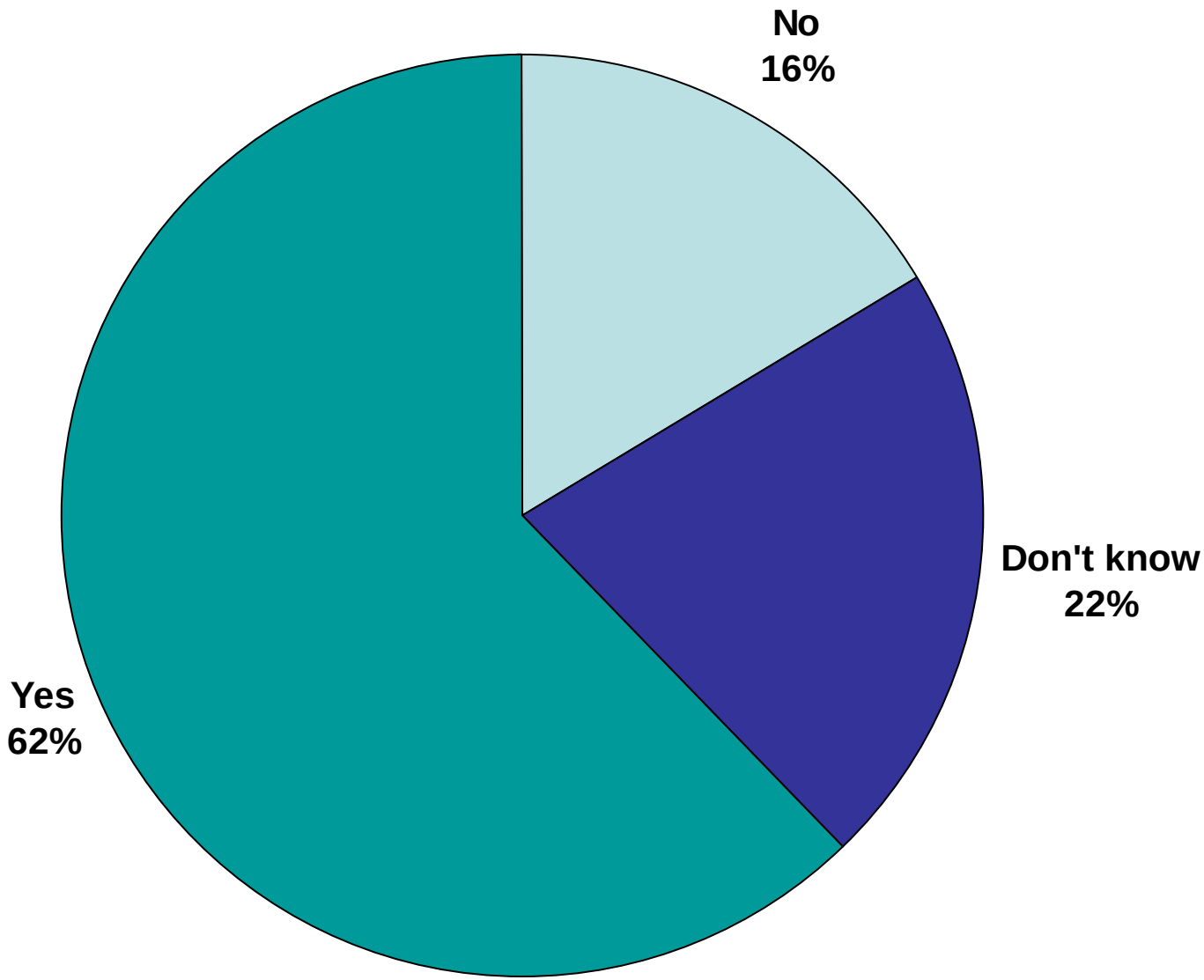
Is the return selective by schooling?

What are the determinants of selectivity?

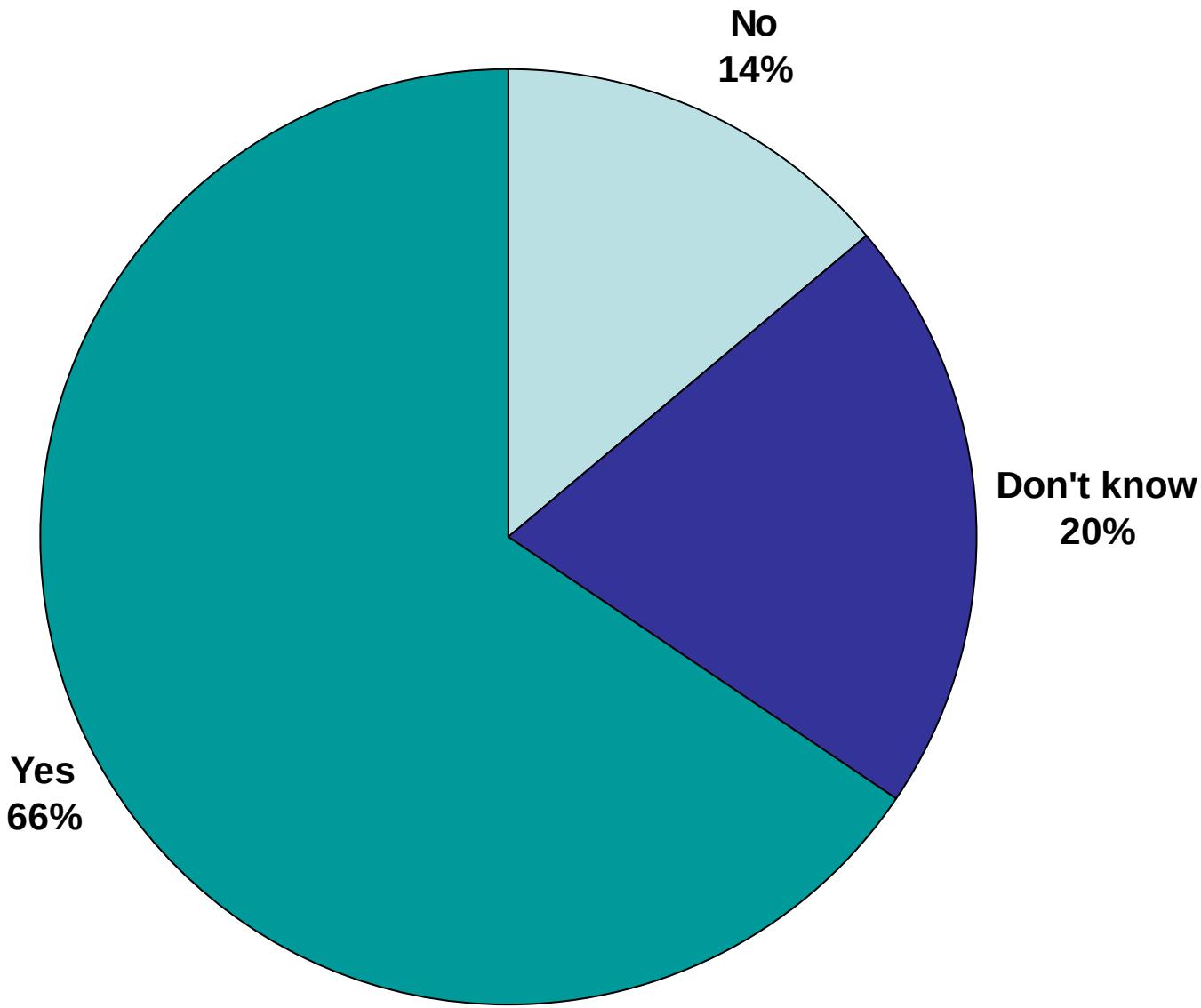
All Visa Holders' Answers:
"Do You Intend to Stay in the United States the Rest of Your Life?



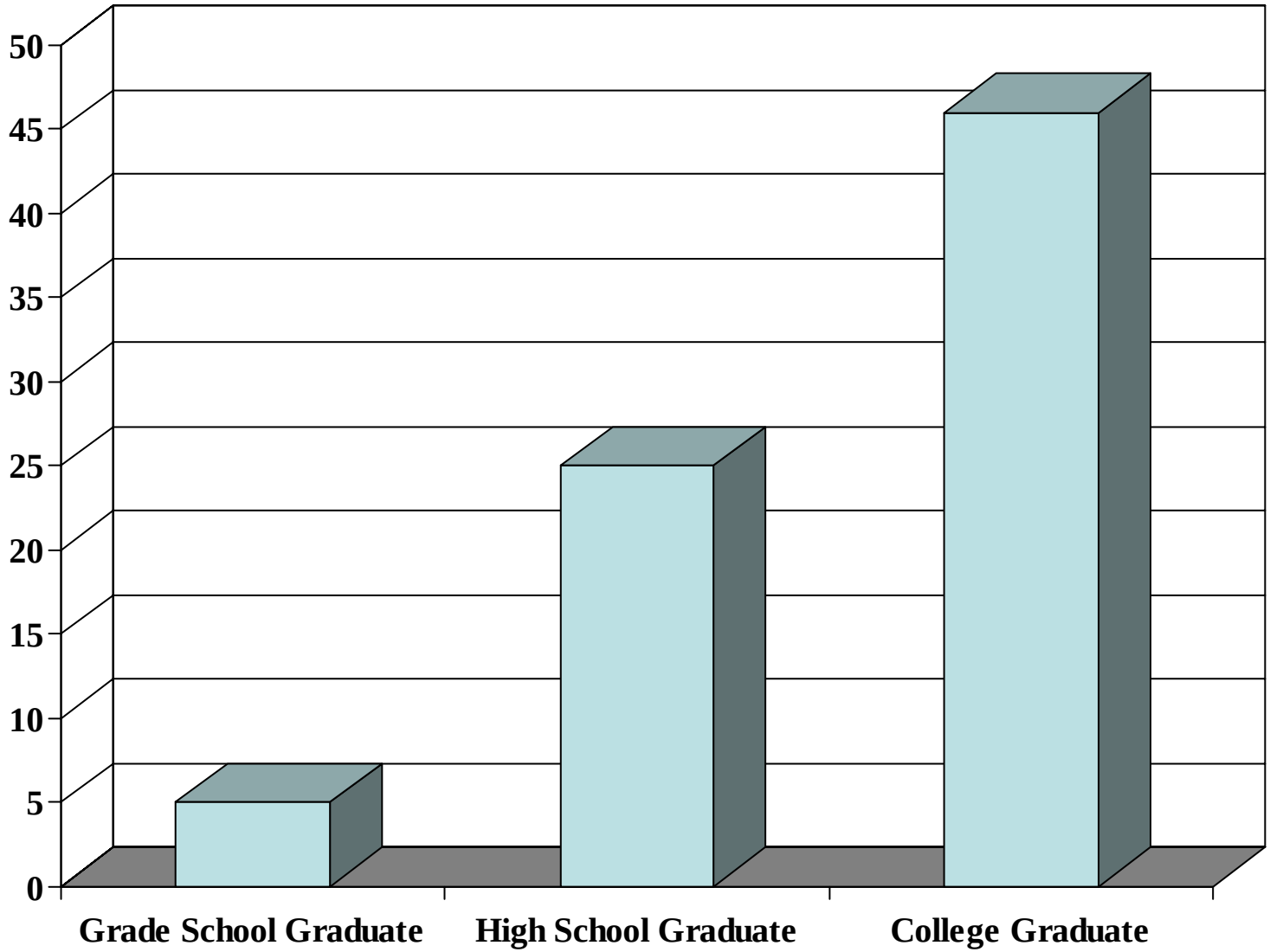
Former Student Visa Holders' Answers:
"Do You Intend to Stay in the United States the Rest of Your Life?



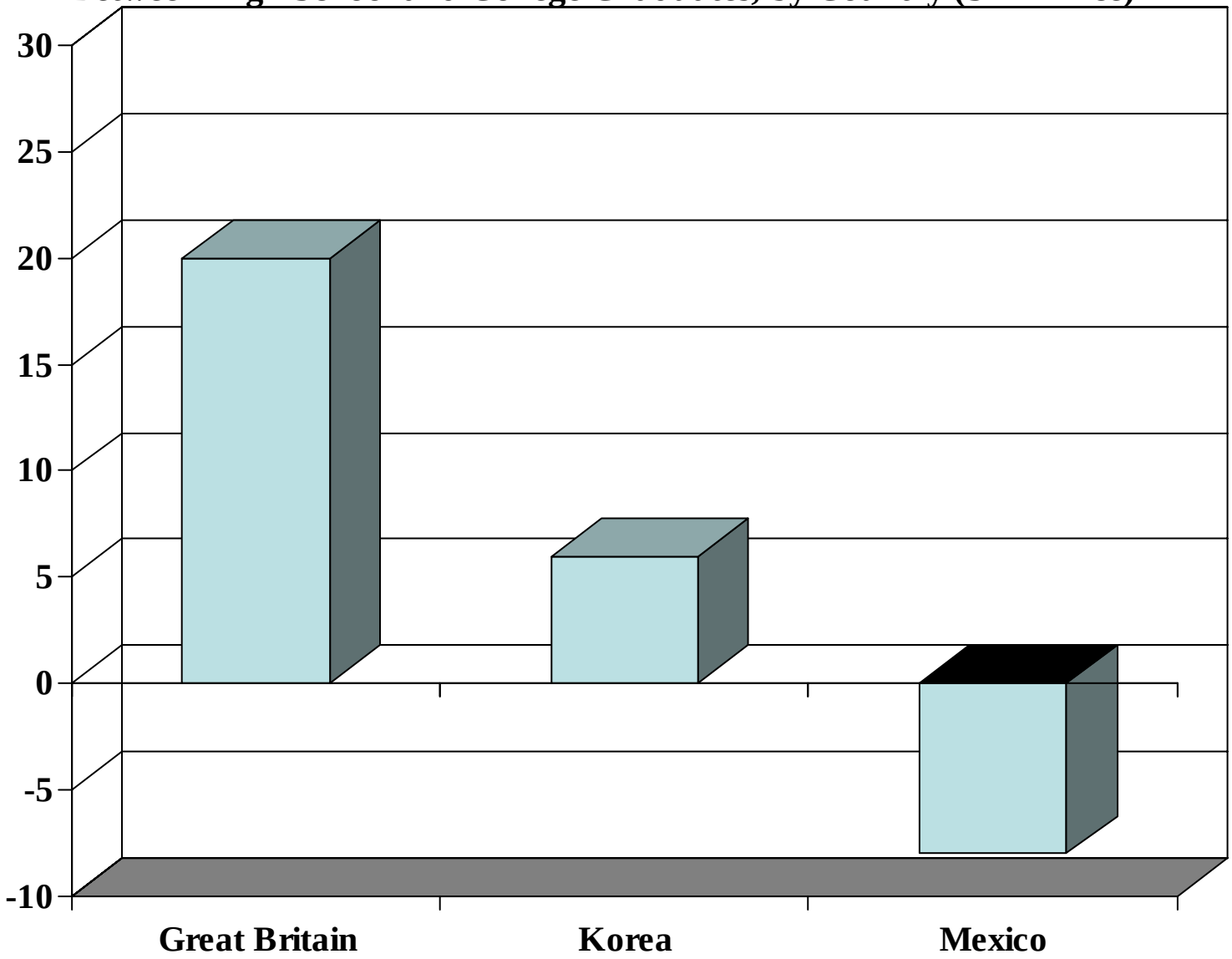
Employment Principal Visa Holders' Answers:
"Do You Intend to Stay in the United States the Rest of Your Life?



Percentage Increase in the Proportion of "Permanent" Immigrants Intending to Return From Doubling the Home-Country Skill Price, by Schooling level



Percentage Difference in the Proportion of "Permanent" Immigrants Intending to Return Between High School and College Graduates, by Country (Skill Price)



Conclusions: Taking the Perspective of Low-Income Countries

The good news:

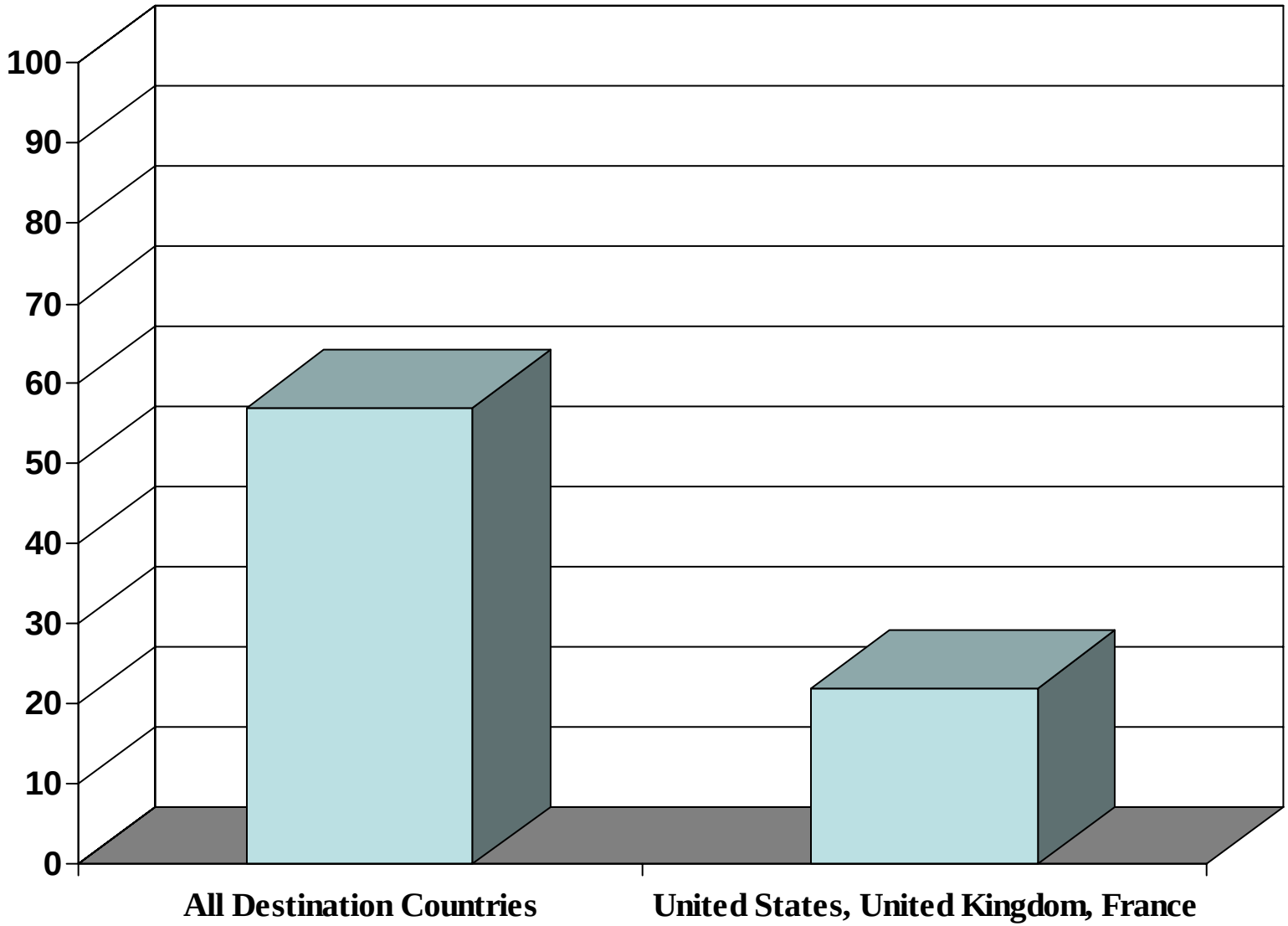
1. The number of foreign-born skilled residing in developed countries substantially overstates the number of people educated in low-income countries who emigrated, and especially overstates the net brain drain.

3. A large number of persons born in low-income countries receive their expensive, higher education in high-income countries, and the vast majority of them return to their home country (despite the fact that the main motivation appears to be wage improvements via migration).

4. A large fraction of "permanent" immigrants return to their home country; this rate is especially high among those immigrants chosen on the basis of their skill.

5. The impact on sending countries of returnees trained or with experience abroad can be large, if leaders matter.

Brain Gain? Percentage of World Leaders (115 Countries) in 1990 with Foreign Tertiary Schooling [Source: Spilimbergo (2006)]



The bad news:

1. The gaps between low skill-price and high-skill price countries, and thus the private gains from migration, are enormous, especially for the high-skilled.

2. Although high skill out-migration is more prevalent in high-skill price countries, both high *and* low skill immigrants leave low skill-price countries.

3. Efforts to increase the number of skilled persons through increasing the number of schools will lead to more out-migration of skilled persons in low skill-price countries.

4. Return migration rates of the schooled-abroad and immigrants are significantly (a) lower and (b) less skilled on average for low- than for high-skill price countries.

The first-order issue is addressing why rewards to skills are low in low-income countries, for which high out-migration and low return-migration are important symptoms.