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International STEM Students:

U.S. Doctoral Degree Attainment

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This Presentation Will…

- Characterize foreign S&E doctoral attainment at US universities
- **96,466** foreign S&E doctorates attained
  - From 1994 to 2005
  - Population:181 nations/regions
  - 5 S&E Fields
  - Thanks to (NSF) Survey of Earned Doctorates (SED)

Conceptual Framework

- A case of highly-skilled migration
  - Measurement problems: “large error bar” (Hart 2006, Myers 1972)
- Foreign S&E doctoral pipelines
  - Home nation S&E education pipelines
  - Foreign student pipelines
  - One component of a global network
  - Doctoral attainment not just a data point!

Role of U.S. Universities

- Global recruitment function
  - Including quality control
- “PhD Factory”
  - Workforce education and training
  - Benefits to the university
- Science community role (Merton, Kuhn)
  - Agents of “creative destruction”

Role of U.S. Government

- Highly subsidized by U.S. government to promote “general training” public goods (Becker)
- Administrative role, not an executive one (Friedman)
- Demonstrated interest in supporting these foreign student pipelines (House Science Committee, 2004)

Foreign S&E Doctoral Attainment by year…

…and by percent of the total for both U.S. citizens and foreign students

- 1980: **2,842** (16 percent)
- 1994: **6,950** (26 percent)
- 2005: **11,109** (38 percent)

S&E Foreign Doctorate Share by Field, 2005

- Physical Sciences: 43%
- Life Sciences: 28%
- Engineering: 61%
- Mathematics and Computer Sciences 54%
- Social and Behavioral Sciences 21%

Four Nations Dominate: 1994 to 2005

Nation	Total SE Doctorates	Share
China	23,375	24%
India	10,836	11%
South Korea	10,500	11%
Taiwan	8,242	9%
Four Nations	52,953	55%
Total	96,466	100%

Growth in Foreign S&E Doctoral Attainment

- China
  - Large increase
- India and South Korea
  - Slow or no growth
- Taiwan
  - Large decrease

Chinese Doctoral Attainment Growth

S&E Field	1994	Share	2005	Share
Physical	113	11%	646	36%
Life	124	8%	781	32%
Engineering	136	6%	1,519	39%
Mathematics and Computer Sciences	36	5%	527	39%
Social and Behavioral Sciences	26	3%	181	13%

Research Findings

- 1994-1997 (Model)
  - Foreign doctorates tended to come from higher income nations in some S&E fields
- 1998-2005 (Model)
  - National income variable no longer significant--except Soc/Beh. Sciences
  - Representation roughly based on national populations

Conclusions

- Foreign S&E doctorates represent an increasing component of the American S&T human capital base
- U.S. public policy should focus on maximizing the benefits associated with this group of talented people
- These foreign S&E pipelines merit continued study

Backup Slides

Indian Doctoral Attainment Growth

S&E Field	1994	Share	2005	Share
Physical	128	12%	143	8%
Life	182	11%	352	14%
Engineering	464	19%	564	14%
Mathematics and Computer Sciences	130	18%	130	10%
Social and Behavioral Sciences	76	7%	71	5%

South Korean Doctoral Attainment Growth

S&E Field	1994	Share	2005	Share
Physical	172	16%	139	8%
Life	174	11%	174	7%
Engineering	338	14%	479	12%
Mathematics and Computer Sciences	79	11%	117	8%
Social and Behavioral Sciences	214	21%	196	14%

Taiwanese Doctoral Attainment Growth

S&E Field	1994	Share	2005	Share
Physical	137	13%	56	3%
Life	249	16%	151	6%
Engineering	562	23%	170	4%
Mathematics and Computer Sciences	97	14%	40	3%
Social and Behavioral Sciences	96	9%	54	4%