# Are They the Best and the Brightest? Analysis of Employer-Sponsored Tech Immigrants

#### Norm Matloff Department of Computer Science University of California at Davis

Institute for the Study of International Migration Georgetown University March 18, 2011

(中) (문) (문) (문) (문)

• ... "[restrictive U.S. immigration policy is] driving away the world's best and brightest" — Bill Gates, 2007

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- … "[restrictive U.S. immigration policy is] driving away the world's best and brightest"—Bill Gates, 2007
- "We should not [send our] bright and talented international students...to work for our competitors abroad upon graduation"-NAFSA (Nat. Assoc. of Foreign Student Advisers)

- … "[restrictive U.S. immigration policy is] driving away the world's best and brightest"—Bill Gates, 2007
- "We should not [send our] bright and talented international students...to work for our competitors abroad upon graduation"-NAFSA (Nat. Assoc. of Foreign Student Advisers)
- "...we should be stapling a green card to the diploma of any foreign student who earns an advanced degree at any U.S. university... The world's best brains are on sale. Let's buy more!"—New York Times columnist Tom Friedman, 2009

- … "[restrictive U.S. immigration policy is] driving away the world's best and brightest"—Bill Gates, 2007
- "We should not [send our] bright and talented international students...to work for our competitors abroad upon graduation"-NAFSA (Nat. Assoc. of Foreign Student Advisers)
- "...we should be stapling a green card to the diploma of any foreign student who earns an advanced degree at any U.S. university... The world's best brains are on sale. Let's buy more!"—New York Times columnist Tom Friedman, 2009
- Industry wants more H-1B work visas, and fast-track green cards for STEM foreign students.

• We all support the immigration of outstanding talents, the innovative, the "game changers," etc.

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

- We all support the immigration of outstanding talents, the innovative, the "game changers," etc.
- But are most of those sponsored by the tech industry of that caliber?

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- We all support the immigration of outstanding talents, the innovative, the "game changers," etc.
- But are most of those sponsored by the tech industry of that caliber?

• How do rates of top foreign talent vary from employer to employer?

- We all support the immigration of outstanding talents, the innovative, the "game changers," etc.
- But are most of those sponsored by the tech industry of that caliber?

- How do rates of top foreign talent vary from employer to employer?
- What are rates of top foreign talent among the main nationalities, i.e. Chinese and Indian?

 $^{1}$ American = U.S. citizen (native or naturalized) or green card holder  $\sim$   $_{\odot}$ 

• (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.

<sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder  $\sim$   $\geq$   $\circ \circ \circ$ 

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder  $\rightarrow$   $\equiv$  9 @ @

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder  $\bullet$   $\bullet$   $\circ \circ \circ \circ$ 

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)
  - $\bullet\,$  immigrants patent at rates  $\leq\,$  natives

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder.  $\square$   $\square$   $\square$ 

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)
  - $\bullet\,$  immigrants patent at rates  $\leq\,$  natives
  - immigrants had more research pubs and higher rates of entrepreneurship

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder  $\rightarrow$   $\equiv$  9 @ @

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)
  - $\bullet\,$  immigrants patent at rates  $\leq\,$  natives
  - immigrants had more research pubs and higher rates of entrepreneurship
- Not much else.

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder  $\rightarrow$   $\equiv$  9 @ @

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)
  - $\bullet\,$  immigrants patent at rates  $\leq\,$  natives
  - immigrants had more research pubs and higher rates of entrepreneurship
- Not much else.
- I'm considering only studies that provide comparison to Americans.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder  $\rightarrow$   $\geq$  9 @ @

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)
  - $\bullet\,$  immigrants patent at rates  $\leq\,$  natives
  - immigrants had more research pubs and higher rates of entrepreneurship
- Not much else.
- I'm considering only studies that provide comparison to Americans.<sup>1</sup>
- E.g. reporting plain #s of immigrant patents is NOT meaningful.

<sup>&</sup>lt;sup>1</sup>American = U.S. citizen (native or naturalized) or green card holder.  $\square$   $\square$   $\square$ 

- (North, 1995) found foreign engineering PhD students were concentrated in lower-ranked universities.
- (Hunt, 2009, 2011) considered general immigrants, not just STEM. Found:
  - immigrants paid less (but Europeans paid more)
  - $\bullet\,$  immigrants patent at rates  $\leq\,$  natives
  - immigrants had more research pubs and higher rates of entrepreneurship
- Not much else.
- I'm considering only studies that provide comparison to Americans.<sup>1</sup>
- E.g. reporting plain #s of immigrant patents is NOT meaningful. (Lots of immigrants ⇒ lots of immigrant patents.)

 $<sup>^{1}</sup>$ American = U.S. citizen (native or naturalized) or green card holder. = -9 C

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ



◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ

#### Focus:

• Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

#### • Focus:

- Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
- So, I focus on computer science and electrical engineering.

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

#### • Focus:

- Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
- So, I focus on computer science and electrical engineering.

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

• CS/EE forms the bulk of H-1Bs.

#### • Focus:

- Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
- So, I focus on computer science and electrical engineering.

- CS/EE forms the bulk of H-1Bs.
- For CS/EE, I know "where the bodies are buried."

- Focus:
  - Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
  - So, I focus on computer science and electrical engineering.

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

- CS/EE forms the bulk of H-1Bs.
- For CS/EE, I know "where the bodies are buried."
- Criteria for "best and brightest":

- Focus:
  - Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
  - So, I focus on computer science and electrical engineering.

- CS/EE forms the bulk of H-1Bs.
- For CS/EE, I know "where the bodies are buried."
- Criteria for "best and brightest":
  - Higher salaries than Americans.

- Focus:
  - Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
  - So, I focus on computer science and electrical engineering.

- CS/EE forms the bulk of H-1Bs.
- For CS/EE, I know "where the bodies are buried."
- Criteria for "best and brightest":
  - Higher salaries than Americans.
  - Higher % of awards than Americans.

- Focus:
  - Mixing quite disparate groups (all STEM fields) ignores interaction effects, thus clouding issues.
  - So, I focus on computer science and electrical engineering.

- CS/EE forms the bulk of H-1Bs.
- For CS/EE, I know "where the bodies are buried."
- Criteria for "best and brightest":
  - Higher salaries than Americans.
  - Higher % of awards than Americans.
  - Higher % of patents than Americans.

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ

• Numbers of research publications:

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

- Numbers of research publications:
  - "Deans can count but they can't read."

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

- Numbers of research publications:
  - "Deans can count but they can't read."

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

• Many researchers are "CV builders."

- Numbers of research publications:
  - "Deans can count but they can't read."

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- Many researchers are "CV builders."
- Quantity  $\neq$  quality.

- Numbers of research publications:
  - "Deans can count but they can't read."

▲□▶ ▲圖▶ ▲臣▶ ▲臣▶ = 臣 = のへで

- Many researchers are "CV builders."
- Quantity  $\neq$  quality.
- Entrepreneurship:

# Criteria NOT Used

- Numbers of research publications:
  - "Deans can count but they can't read."
  - Many researchers are "CV builders."
  - Quantity  $\neq$  quality.
- Entrepreneurship:
  - Entrepreneurship  $\neq$  innovation/U.S. jobs.

# Criteria NOT Used

- Numbers of research publications:
  - "Deans can count but they can't read."
  - Many researchers are "CV builders."
  - Quantity  $\neq$  quality.
- Entrepreneurship:
  - Entrepreneurship  $\neq$  innovation/U.S. jobs.
  - Saxenian (1999) found that 36% of Chinese-immigrant firms were in "Computer [PC] Wholesaling."

# Criteria NOT Used

- Numbers of research publications:
  - "Deans can count but they can't read."
  - Many researchers are "CV builders."
  - Quantity  $\neq$  quality.
- Entrepreneurship:
  - Entrepreneurship  $\neq$  innovation/U.S. jobs.
  - Saxenian (1999) found that 36% of Chinese-immigrant firms were in "Computer [PC] Wholesaling."
  - Many Indian-immigrant firms are in the outsourcing business.

• Foreign workers exploitable, esp. if sponsored for green card.

<sup>2</sup>Similar loopholes for legal definition of "actual wage." ( $\square$ ) (( $\square$ ) ( $\square$ ) ( $\square$ ) (( $\square$ ) ( $\square$ ) (( $\square$ ) (( $\square$ ) (( $\square$ ) (( $\square$ )

- Foreign workers exploitable, esp. if sponsored for green card.
- Underpayment found to be 15-20% in (Matloff, 2003) and 33% in (Ong, 1997). (Separate from age issues.)

<sup>&</sup>lt;sup>2</sup>Similar loopholes for legal definition of "actual wage." ( ) ( ) ( ) ( ) ( ) ( ) ( )

- Foreign workers exploitable, esp. if sponsored for green card.
- Underpayment found to be 15-20% in (Matloff, 2003) and 33% in (Ong, 1997). (Separate from age issues.)
- Underpayment due to **loopholes** in *prevailing wage*.<sup>2</sup>

²Similar loopholes for legal definition of "actual wage." (ㅋ) (ㅋ) (ㅋ) (ㅋ)

- Foreign workers exploitable, esp. if sponsored for green card.
- Underpayment found to be 15-20% in (Matloff, 2003) and 33% in (Ong, 1997). (Separate from age issues.)
- Underpayment due to **loopholes** in *prevailing wage*.<sup>2</sup>
- Congressionally-commissioned employer surveys, (NRC 2001) and (GAO 2003), found many employers admitting to paying H-1B workers less than comparable Americans.

²Similar loopholes for legal definition of "actual wage." 🖅 🚛 🚛 🔊 🧟

- Foreign workers exploitable, esp. if sponsored for green card.
- Underpayment found to be 15-20% in (Matloff, 2003) and 33% in (Ong, 1997). (Separate from age issues.)
- Underpayment due to **loopholes** in *prevailing wage*.<sup>2</sup>
- Congressionally-commissioned employer surveys, (NRC 2001) and (GAO 2003), found many employers admitting to paying H-1B workers less than comparable Americans.
- GAO even noted role of loopholes:

... [employers] hired H-1B workers in part because these workers would often accept lower salaries...however, these employers said they never paid H-1B workers less than the required wage.

### Solutions to Wage Issues

▲□▶ ▲圖▶ ▲≣▶ ▲≣▶ ▲国 ● ● ●

• Analyses based on wages must account for the underpayment of H-1Bs.

• Analyses based on wages must account for the underpayment of H-1Bs.

• Where possible restriction attention to green card holders (LPRs) and nat. citizens.

 Analyses based on wages must account for the underpayment of H-1Bs.

- Where possible restriction attention to green card holders (LPRs) and nat. citizens.
- Artificially "raise" H-1B salaries by factor 1.2.

## Nationality Issues

▲□▶ ▲圖▶ ▲≣▶ ▲≣▶ ▲国 ● ● ●

## Nationality Issues

Majority of tech foreign workers are Indians and Chinese.

Majority of tech foreign workers are Indians and Chinese.

 Among computer-related H-1Bs, 64.8% Indian, 8.2% Chinese (Filipinos third, at 2.3%) (INS, 2001).

Majority of tech foreign workers are Indians and Chinese.

- Among computer-related H-1Bs, 64.8% Indian, 8.2% Chinese (Filipinos third, at 2.3%) (INS, 2001).
- In 2009 employer apps for worker green cards, 59.0% were for Indians and 7.5% for Chinese.

Majority of tech foreign workers are Indians and Chinese.

- Among computer-related H-1Bs, 64.8% Indian, 8.2% Chinese (Filipinos third, at 2.3%) (INS, 2001).
- In 2009 employer apps for worker green cards, 59.0% were for Indians and 7.5% for Chinese.
- Among those who (ever) came to U.S. as foreign students in CS/EE and were working in CS/EE as of 2003, 23.2% were Chinese and 27.2% were Indian.

## Interesting Time Trend

(ロ)、(型)、(E)、(E)、 E) の(の)

#### CSEE EB green cards apps trend $\downarrow$ for Chinese, $\uparrow$ for Indians:



#### CSEE EB green cards apps trend $\downarrow$ for Chinese, $\uparrow$ for Indians:

year	China	India
2005	0.134	0.444
2006	0.103	0.501
2007	0.097	0.515
2008	0.080	0.569
2009	0.075	0.590

# First Wage Analysis: NSCG Data

### First Wage Analysis: NSCG Data

#### • National Survey of College Graduates (2003) (Hunt's data)

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

• National Survey of College Graduates (2003) (Hunt's data)

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

• My focus: Degree and (nonacademic) job in CS/EE.

• National Survey of College Graduates (2003) (Hunt's data)

- My focus: Degree and (nonacademic) job in CS/EE.
- My focus: Green card holders and citizens only.

- National Survey of College Graduates (2003) (Hunt's data)
- My focus: Degree and (nonacademic) job in CS/EE.
- My focus: Green card holders and citizens only.
- My focus: Imms. came to U.S. as foreign students (F-1).

## NSCG Salaries: Results

### NSCG Salaries: Results

Regression model; response variable is salary.

factor	beta, marg. err.
const.	$-3272\pm18383$
age	$3400\pm863$
$age \times age$	$-34\pm10$
MS	$8809\pm2173$
PhD	$22495\pm4512$
highCOL	$8725\pm1918$
origF1	$808\pm3019$

factor	beta, marg. err.
const.	$-3272\pm18383$
age	$3400\pm863$
$age \times age$	$-34\pm10$
MS	$8809\pm2173$
PhD	$22495\pm4512$
highCOL	$8725\pm1918$
origF1	$808\pm3019$

• note negative quadratic age effect

factor	beta, marg. err.
const.	$-3272\pm18383$
age	$3400\pm863$
$age \times age$	$-34\pm10$
MS	$8809\pm2173$
PhD	$22495\pm4512$
highCOL	$8725\pm1918$
origF1	$808\pm3019$

 note negative quadratic age effect

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

 highCOL = high cost-of-living region

factor	beta, marg. err.
const.	$-3272\pm18383$
age	$3400\pm863$
$age \times age$	$-34\pm10$
MS	$8809\pm2173$
PhD	$22495\pm4512$
highCOL	$8725\pm1918$
origF1	$808\pm3019$

- note negative quadratic age effect
- highCOL = high cost-of-living region
- origF1 = came to U.S. as foreign student

factor	beta, marg. err.
const.	$-3272\pm18383$
age	$3400\pm863$
$age \times age$	$-34\pm10$
MS	$8809\pm2173$
PhD	$22495\pm4512$
highCOL	$8725\pm1918$
origF1	$808\pm3019$

- note negative quadratic age effect
- highCOL = high cost-of-living region
- origF1 = came to U.S. as foreign student
- no overall evidence of "best and brightest"

Separate out the Indians and Chinese ("ICs").



Separate out the Indians and Chinese ("ICs").

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

factor	beta, marg. err.
const.	$-2640\pm18429$
age	$3369\pm865$
age $ imes$ age	$-33\pm10$
MS	$9948\pm2177$
PhD	$22667~\pm~4509$
highCOL	$8692\pm1917$
origF1nonIC	$4479\pm3847$
origF1chn	$-6190\pm5632$
origF1ind	$-978~\pm~5571$

Separate out the Indians and Chinese ("ICs").

factor	beta, marg. err.
const.	$-2640\pm18429$
age	$3369\pm865$
age $ imes$ age	$-33\pm10$
MS	$9948\pm2177$
PhD	$22667~\pm~4509$
highCOL	$8692\pm1917$
origF1nonIC	$4479\pm3847$
origF1chn	$\textbf{-6190} \pm 5632$
origF1ind	$-978~\pm~5571$

 non-ICs paid > avg., about 0.5 MS effect

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

Separate out the Indians and Chinese ("ICs").

factor	beta, marg. err.
const.	$-2640\pm18429$
age	$3369\pm865$
age $ imes$ age	$-33\pm10$
MS	$9948\pm2177$
PhD	$22667~\pm~4509$
highCOL	$8692\pm1917$
origF1nonIC	$4479\pm3847$
origF1chn	$-6190\pm5632$
origF1ind	$-978~\pm~5571$

- non-ICs paid > avg., about 0.5 MS effect
- Chinese paid < avg. about 2/3 MS effect

#### Second Wage Analysis: PERM Data

(ロ)、(型)、(E)、(E)、 E) のQの

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

• Enables analysis by employer and nationality.

- Enables analysis by employer and nationality.
- Accounts for region via prevailing wage.

- Enables analysis by employer and nationality.
- Accounts for region via prevailing wage.
- Lacks data on education, age.

(ロ) (四) (主) (主) (三)

• I calculated the median wage ratio:

WR = median of

actual wage emp. claimed prev. wg.

• I calculated the median wage ratio:

 $\label{eq:WR} WR = median \mbox{ of } \ \frac{actual \mbox{ wage}}{emp. \ claimed \ prev. \ wg.}$  $\bullet$  By law, must have  $W\!R \geq 1.$ 

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

I calculated the median wage ratio:

 $WR = median of \frac{actual wage}{emp. claimed prev. wg.}$ 

- By law, must have  $WR \ge 1$ .
- But, denominator too small by factor of 1.15 to 1.33 (prev. wg. def. loopholes).

I calculated the median wage ratio:

WR = median of

actual wage emp. claimed prev. wg.

- By law, must have  $WR \ge 1$ .
- But, denominator too small by factor of 1.15 to 1.33 (prev. wg. def. loopholes).
- "Best and brightest" salary premiums (U.S. workers):

I calculated the median wage ratio:

WR = median of

actual wage emp. claimed prev. wg.

- By law, must have  $WR \ge 1$ .
- But, denominator too small by factor of 1.15 to 1.33 (prev. wg. def. loopholes).
- "Best and brightest" salary premiums (U.S. workers):
  - New Stanford CS grads earn 37% more than average CS.

I calculated the median wage ratio:

WR = median of

actual wage emp. claimed prev. wg.

- By law, must have  $WR \ge 1$ .
- But, denominator too small by factor of 1.15 to 1.33 (prev. wg. def. loopholes).
- "Best and brightest" salary premiums (U.S. workers):
  - New Stanford CS grads earn 37% more than average CS.
  - 20 years after graduation, Stanford grads (general) earn 28% more than San Jose State Unv. grads.

I calculated the median wage ratio:

WR = median of

actual wage emp. claimed prev. wg.

- By law, must have  $WR \ge 1$ .
- But, denominator too small by factor of 1.15 to 1.33 (prev. wg. def. loopholes).
- "Best and brightest" salary premiums (U.S. workers):
  - New Stanford CS grads earn 37% more than average CS.
  - 20 years after graduation, Stanford grads (general) earn 28% more than San Jose State Unv. grads.
  - Grads (general) of most selective schools have starting salaries 45% more than least selective.

• I calculated the median wage ratio:

WR = median of

actual wage emp. claimed prev. wg.

- By law, must have  $WR \ge 1$ .
- But, denominator too small by factor of 1.15 to 1.33 (prev. wg. def. loopholes).
- "Best and brightest" salary premiums (U.S. workers):
  - New Stanford CS grads earn 37% more than average CS.
  - 20 years after graduation, Stanford grads (general) earn 28% more than San Jose State Unv. grads.
  - Grads (general) of most selective schools have starting salaries 45% more than least selective.
- So, only (median) WR values higher than, say 1.25, indicate a firm is hiring mainly the "best and brightest" foreign workers.

group	med. WR
SE	1.01
EE	1.00
Chinese SE	1.02
Indian SE	1.01
Chinese EE	1.01
Indian EE	1.01

group	med. WR
SE	1.01
EE	1.00
Chinese SE	1.02
Indian SE	1.01
Chinese EE	1.01
Indian EE	1.01

• Almost no variation.

group	med. WR
SE	1.01
EE	1.00
Chinese SE	1.02
Indian SE	1.01
Chinese EE	1.01
Indian EE	1.01

- Almost no variation.
- Shows that most employers use Prev. Wg., not Actual Wg. (see previous footnote).

group	med. WR
SE	1.01
EE	1.00
Chinese SE	1.02
Indian SE	1.01
Chinese EE	1.01
Indian EE	1.01

- Almost no variation.
- Shows that most employers use Prev. Wg., not Actual Wg. (see previous footnote).
- No overall evidence of "best and brightest."

(ロ)、(型)、(E)、(E)、 E) の(の)

Median WR for some prominent firms with large numbers of PERM entries:

Median WR for some prominent firms with large numbers of PERM entries:

firm	WR	n
HP	1.20	243
Microsoft	1.18	4039
Intel	1.14	1465
Oracle	1.13	830
Google	1.12	690
eBay	1.05	118
Cisco	1.04	1135
Motorola	1.00	848
Qualcomm	1.00	268

Median WR for some prominent firms with large numbers of PERM entries:

firm	WR	n
HP	1.20	243
Microsoft	1.18	4039
Intel	1.14	1465
Oracle	1.13	830
Google	1.12	690
eBay	1.05	118
Cisco	1.04	1135
Motorola	1.00	848
Qualcomm	1.00	268

• Considerable variation among firms.

Median WR for some prominent firms with large numbers of PERM entries:

firm	WR	n
HP	1.20	243
Microsoft	1.18	4039
Intel	1.14	1465
Oracle	1.13	830
Google	1.12	690
eBay	1.05	118
Cisco	1.04	1135
Motorola	1.00	848
Qualcomm	1.00	268

- Considerable variation among firms.
- But remember, different firms use different methods for calculating prev. wg.

Median WR for some prominent firms with large numbers of PERM entries:

firm	WR	n
HP	1.20	243
Microsoft	1.18	4039
Intel	1.14	1465
Oracle	1.13	830
Google	1.12	690
eBay	1.05	118
Cisco	1.04	1135
Motorola	1.00	848
Qualcomm	1.00	268

- Considerable variation among firms.
- But remember, different firms use different methods for calculating prev. wg.
- A few firms pay a 10-15% premium.

Median WR for some prominent firms with large numbers of PERM entries:

firm	WR	n
HP	1.20	243
Microsoft	1.18	4039
Intel	1.14	1465
Oracle	1.13	830
Google	1.12	690
eBay	1.05	118
Cisco	1.04	1135
Motorola	1.00	848
Qualcomm	1.00	268

- Considerable variation among firms.
- But remember, different firms use different methods for calculating prev. wg.
- A few firms pay a 10-15% premium.
- No firm has WR high enough to qualify as hiring "best and brightest."

## ACM Dissertation Awards

 Assoc. for Computing Machinery, the main professional CS body

Assoc. for Computing Machinery, the main professional CS body

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

• 58 awards since 1982

- Assoc. for Computing Machinery, the main professional CS body
- 58 awards since 1982
- no direct data on foreign/domestic; names used as proxies

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- Assoc. for Computing Machinery, the main professional CS body
- 58 awards since 1982
- no direct data on foreign/domestic; names used as proxies
- 25 of the 58 foreign, slightly underrepresented, 43%, similar to 42% figure for foreign among CS PhDs overall (NSCG)

- Assoc. for Computing Machinery, the main professional CS body
- 58 awards since 1982
- no direct data on foreign/domestic; names used as proxies
- 25 of the 58 foreign, slightly underrepresented, 43%, similar to 42% figure for foreign among CS PhDs overall (NSCG)
- no evidence that the foreign students are outperforming the domestic ones

## ACM Awards, contd.

Of 58 awards, 2 from China, 8 from India.



#### Of 58 awards, 2 from China, 8 from India.

nationality	% of awardees	% of CS PhDs
China	$3.5\%\pm4.8\%$	$28.6\%\pm8.1\%$
India	$13.8\%\pm9.1\%$	$19.0\%\pm7.0\%$

#### Of 58 awards, 2 from China, 8 from India.

nationality	% of awardees	% of CS PhDs
China	$3.5\%\pm4.8\%$	$28.6\%\pm8.1\%$
India	$13.8\% \pm 9.1\%$	$19.0\%\pm7.0\%$

• Chinese award rate much lower than average

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへで

#### Of 58 awards, 2 from China, 8 from India.

nationality	% of awardees	% of CS PhDs
China	$3.5\%\pm4.8\%$	$28.6\%\pm8.1\%$
India	$13.8\%\pm9.1\%$	$19.0\%\pm7.0\%$

• Chinese award rate much lower than average

▲□▶ ▲□▶ ▲三▶ ▲三▶ 三三 のへで

• Indian rate could be about average

# Patents: NSCG

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ



◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

factor	beta $\pm$ marg. err.
const.	$0.11 \pm 0.31$
age	$0.00\pm0.01$
MS	$0.25\pm0.15$
PhD	$2.65\pm0.29$
origF1	$0.04\pm0.19$

factor	beta $\pm$ marg. err.
const.	$0.11 \pm 0.31$
age	$0.00\pm0.01$
MS	$0.25\pm0.15$
PhD	$2.65\pm0.29$
origF1	$0.04\pm0.19$

• No overall "best and brightest" effect.

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

factor	beta $\pm$ marg. err.
const.	$0.11 \pm 0.31$
age	$0.00\pm0.01$
MS	$0.25\pm0.15$
PhD	$2.65\pm0.29$
origF1	$0.04\pm0.19$

- No overall "best and brightest" effect.
- PhD only major effect.

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

# NSCG patents, contd.

・ロト ・ 日本・ 小田 ・ 小田 ・ 今日・



◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

factor	beta $\pm$ marg. err.
const.	$0.11\pm0.31$
age	$0.00\pm0.01$
MS	$0.27\pm0.15$
PhD	$2.65\pm0.29$
origF1nonIC	$0.35\pm0.25$
origF1China	$-0.50\pm0.36$
origF1India	$-0.11\pm0.33$

factor	beta $\pm$ marg. err.
const.	$0.11\pm0.31$
age	$0.00\pm0.01$
MS	$0.27\pm0.15$
PhD	$2.65\pm0.29$
origF1nonIC	$0.35\pm0.25$
origF1China	$-0.50\pm0.36$
origF1India	$\textbf{-0.11}\pm 0.33$

• Chinese MS app count much < than American Bachelor's.

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

factor	beta $\pm$ marg. err.
const.	$0.11\pm0.31$
age	$0.00\pm0.01$
MS	$0.27\pm0.15$
PhD	$2.65\pm0.29$
origF1nonIC	$0.35\pm0.25$
origF1China	$-0.50\pm0.36$
origF1India	$\textbf{-0.11}\pm0.33$

- Chinese MS app count much < than American Bachelor's.</li>
- Non-ICs' Bachelor's count higher than Americans' MS.

#### Why Did the Chinese Workers Fare Poorly?

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

• Well recognized, with its own Chinese term, 填鸭 子—tian yazi, "stuff the duck."

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- Well recognized, with its own Chinese term, 填鸭 子—tian yazi, "stuff the duck."
- A common complaint among prominent Chinese academics, e.g. SUNY Stony Brook's C.N. Yang.

- Well recognized, with its own Chinese term, 填鸭 子—tian yazi, "stuff the duck."
- A common complaint among prominent Chinese academics, e.g. SUNY Stony Brook's C.N. Yang.
- Governments of China, Japan, S. Korea and Taiwan have all tried to remedy this.

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ

Second possible factor: The Chinese workers may be handicapped by language issues.

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

Second possible factor: The Chinese workers may be handicapped by language issues. This seems to not be a strong factor.

Second possible factor: The Chinese workers may be handicapped by language issues. This seems to not be a strong factor.

• Foreign students from China in the last 10-15 years have tended to have very good English.

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

Second possible factor: The Chinese workers may be handicapped by language issues. This seems to not be a strong factor.

- Foreign students from China in the last 10-15 years have tended to have very good English.
- The ACM Dissertation Awards go mostly to students at the elite schools, which have very stringent English requirements for admission.

Second possible factor: The Chinese workers may be handicapped by language issues. This seems to not be a strong factor.

- Foreign students from China in the last 10-15 years have tended to have very good English.
- The ACM Dissertation Awards go mostly to students at the elite schools, which have very stringent English requirements for admission.
- E.g. MIT, Harvard and Columbia require a TOEFL minimum score of 109/120 for admission.

Second possible factor: The Chinese workers may be handicapped by language issues. This seems to not be a strong factor.

- Foreign students from China in the last 10-15 years have tended to have very good English.
- The ACM Dissertation Awards go mostly to students at the elite schools, which have very stringent English requirements for admission.
- E.g. MIT, Harvard and Columbia require a TOEFL minimum score of 109/120 for admission.
- The tech industry is famously meritocratic for engineering (not managerial) workers. If you produce, you are rewarded. English is not a major issue.

Second possible factor: The Chinese workers may be handicapped by language issues. This seems to not be a strong factor.

- Foreign students from China in the last 10-15 years have tended to have very good English.
- The ACM Dissertation Awards go mostly to students at the elite schools, which have very stringent English requirements for admission.
- E.g. MIT, Harvard and Columbia require a TOEFL minimum score of 109/120 for admission.
- The tech industry is famously meritocratic for engineering (not managerial) workers. If you produce, you are rewarded. English is not a major issue.
- Logistic regression analysis on the PUMS census data shows that among immigrant Chinese, English skill has no impact on the probability of earning a high-level salary (> \$150K).

# Is There a CS/EE Labor Shortage?

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 のへぐ

• Even if the foreign workers are not especially talented, their large numbers might be justified if there were a labor shortage.

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

 Even if the foreign workers are not especially talented, their large numbers might be justified if there were a labor shortage.

• But among the many government and other studies, none (other than by the industry) has ever shown a shortage.

 Even if the foreign workers are not especially talented, their large numbers might be justified if there were a labor shortage.

- But among the many government and other studies, none (other than by the industry) has ever shown a shortage.
- Salaries (adjusted for inflation) have been flat, counterindicating a shortage.

- Even if the foreign workers are not especially talented, their large numbers might be justified if there were a labor shortage.
- But among the many government and other studies, none (other than by the industry) has ever shown a shortage.
- Salaries (adjusted for inflation) have been flat, counterindicating a shortage.
- Employers still very picky in hiring, again counterindicating a shortage.

# Internal Brain Drain

<sup>3</sup>Nice graph in GAO report, BTW.

◆□ ▶ < 圖 ▶ < 圖 ▶ < 圖 ▶ < 圖 • 의 Q @</p>

### Internal Brain Drain

A surplus of workers is causing an internal brain drain.

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□▶

<sup>3</sup>Nice graph in GAO report, BTW.

• Workers become less employable around age 35.<sup>3</sup>

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

- Workers become less employable around age 35.<sup>3</sup>
- National Science Foundation advocated H-1B with explicit goal of holding down PhD salaries.

- Workers become less employable around age 35.<sup>3</sup>
- National Science Foundation advocated H-1B with explicit goal of holding down PhD salaries. Forecast (correctly) that stagnant wages would then drive American students away from PhD.

<sup>&</sup>lt;sup>3</sup>Nice graph in GAO report, BTW.

- Workers become less employable around age 35.<sup>3</sup>
- National Science Foundation advocated H-1B with explicit goal of holding down PhD salaries. Forecast (correctly) that stagnant wages would then drive American students away from PhD.
- Stagnant CS/EE salaries at all levels discourage young people from entering the field.

<sup>&</sup>lt;sup>3</sup>Nice graph in GAO report, BTW.

- Workers become less employable around age 35.<sup>3</sup>
- National Science Foundation advocated H-1B with explicit goal of holding down PhD salaries. Forecast (correctly) that stagnant wages would then drive American students away from PhD.
- Stagnant CS/EE salaries at all levels discourage young people from entering the field.
- Post doc program, fueled by H-1B, makes lab science careers extremely unattractive to young people.

<sup>&</sup>lt;sup>3</sup>Nice graph in GAO report, BTW.

- Workers become less employable around age 35.<sup>3</sup>
- National Science Foundation advocated H-1B with explicit goal of holding down PhD salaries. Forecast (correctly) that stagnant wages would then drive American students away from PhD.
- Stagnant CS/EE salaries at all levels discourage young people from entering the field.
- Post doc program, fueled by H-1B, makes lab science careers extremely unattractive to young people.
- "Innovation" is the buzzword *de jour*, and it is U.S.' only comparative advantage. Yet the system is wasting that advantage.

<sup>&</sup>lt;sup>3</sup>Nice graph in GAO report, BTW.

# Discussion: Policy Implications, H-1B

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

• Employer claims that H-1B visas are needed to bring in outstanding talents are not borne out.

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- Employer claims that H-1B visas are needed to bring in outstanding talents are not borne out.
- "We should return the H-1B visa to its original intent, bringing in the best and the brightest"-Rep. Zoe Lofgren, House hearing, 1998.

- Employer claims that H-1B visas are needed to bring in outstanding talents are not borne out.
- "We should return the H-1B visa to its original intent, bringing in the best and the brightest"-Rep. Zoe Lofgren, House hearing, 1998.
- Should prioritize granting of H-1B requests by wage level.

- Employer claims that H-1B visas are needed to bring in outstanding talents are not borne out.
- "We should return the H-1B visa to its original intent, bringing in the best and the brightest"-Rep. Zoe Lofgren, House hearing, 1998.
- Should prioritize granting of H-1B requests by wage level.
- Should adopt Durbin-Grassley definition of prevaling wage.

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

• No best/brightest trend was found here among foreign students.

◆□▶ ◆□▶ ◆臣▶ ◆臣▶ 臣 の�?

- No best/brightest trend was found here among foreign students.
- Thus a blanket green card program for STEM foreign students would be unwarranted.

◆□▶ ◆□▶ ◆三▶ ◆三▶ 三三 のへぐ

- No best/brightest trend was found here among foreign students.
- Thus a blanket green card program for STEM foreign students would be unwarranted.
- Currently have long waits for green cards in EB-3 category—the wrong group to offer a remedy, as it is exactly the one for the least talented workers.

- No best/brightest trend was found here among foreign students.
- Thus a blanket green card program for STEM foreign students would be unwarranted.
- Currently have long waits for green cards in EB-3 category—the wrong group to offer a remedy, as it is exactly the one for the least talented workers.

• Should transfer much of the EB-3 quota to EB-2.