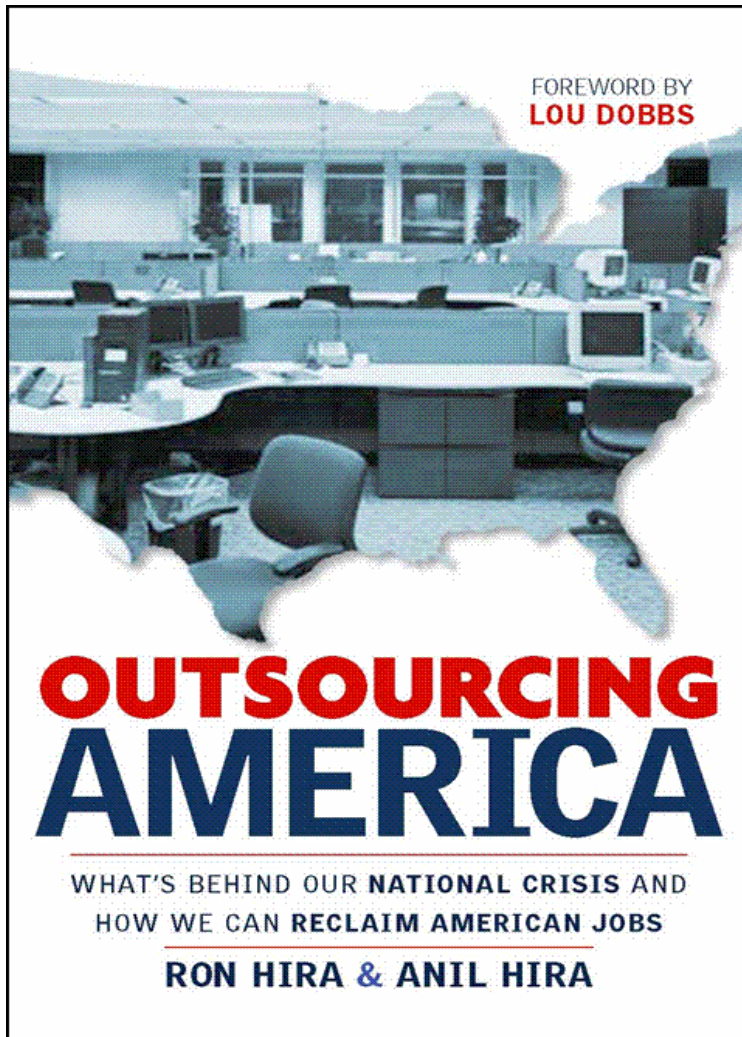


Offshoring Engineering: Trends & Implications



**Ron Hira, Ph.D., P.E.
Rochester Institute of
Technology**

**Keynote Address
Southeastern Regional
Cooperative Education
Conference
Clemson, SC**

May 22, 2008

Larger Trend: Shift in Bargaining Power From Workers to Employers

- Professional Development Responsibility of Employees
 - “On your own time and dime”
- New Employees Get Smaller Benefits Packages
 - General Electric, Dupont, Circuit City
- Business Cycle Risks Shifted to Workers
- Businesses Pursue “Flexible” Labor Markets
- Workers Are Economically & Politically Weak

Larger Trend: Shift in Bargaining Power From Workers to Employers

- Offshoring
 - Enabled by Weak Position of Workers
 - NY Times Career Coach says train your replacement with a smile because you depend on company recommendation
 - Is Intensifying the Shift in Bargaining Power
- Upside
 - Liberating for workers with special skills and initiative

BusinessWeek

FEBRUARY 5, 2002

www.businessweek.com

BEST BOND FUNDS
OUR ANNUAL SCOREBOARD

SILICON VALLEY
TALE OF A HIGH-TECH ZOMBIE

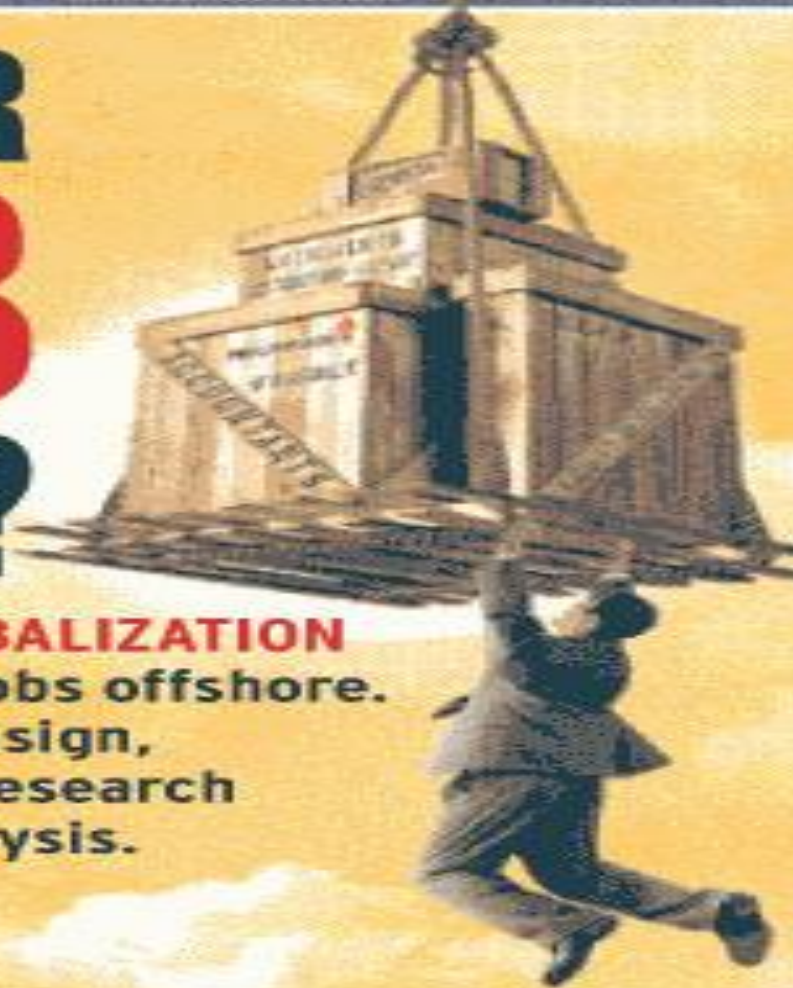
AIRLINES
HOW SOUTHWEST WEATHERS THE STORM

STOCK OPTIONS
COMPANIES ARE GROPING FOR A BETTER WAY

IS YOUR **JOB** NEXT?

A new round of **GLOBALIZATION** is sending upscale jobs offshore. They include chip design, engineering, basic research—even financial analysis. Can America lose these jobs and still prosper?

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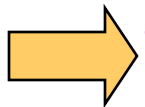


Outsourcing Definitions

- *Outsourcing*: Classic Make or Buy Decision
 - Procter & Gamble contracts with HP for IT services
- *Offshore Outsourcing*
 - Sending work to outsourcers who operate overseas
- *Offshoring*: MNC Captive Facilities
 - Daimler Chrysler has an R&D center in Bangalore
- *On-site Offshore Outsourcing*: Foreign Workers On-site
 - Tata Consultancy Services, Infosys, Wipro, Accenture
- *Insourcing* (media) – Foreign MNCs in US
 - BMW in SC, Infosys Consulting
- *Insourcing* (academics) – Making Rather Than Buying
- *Blended Sourcing, Near Shore, Best Shore, All Sourcing, Global Sourcing, Global Delivery Model, etc.*

Why Companies Utilize Overseas Talent

- **Cost – An “Imperative”**
- Politics & Access to the Local Market
- Developing Countries’ Strategy
 - Tax holidays & Incentives
- Economic Liberalization – 3 Billion New Capitalists
- Collaborative Engineering Technology
- Low Cost Telecommunications & Internet
- **Fate Of US Workers No Longer Figures Into Corporate Decisions**



Overseas Workers

Can Afford To Be Paid Less

<u>Country</u>	<u>Purchasing Power Parity (PPP)</u>	<u>Salary</u>
U.S.	1.0 * \$70k	\$70,000
Hungary	0.367 * \$70k	\$25,690
China	0.216 * \$70k	\$15,120
Russia	0.206 * \$70k	\$14,420
India	0.194 * \$70k	\$13,580

Implications of Cost of Living Differentials

- US Workers Must Justify 5X + Salary Levels
 - Obvious answer is to be 5X more productive
 - Not so obvious: How?
- Low Indian, Chinese & Russian Salaries Likely to Persist for Many Years
 - Wage increases on very low bases
 - Governor on workers' salary expectations
 - Most of what they buy will remain 'non-tradable'
- Excess Supply of Labor & More On-line
 - Increase in graduates and more countries target offshoring as a development strategy (UNCTAD, WB)

How Much Work Has Moved Offshore?

- No One Knows
- Political Appointees Re-write (Whitewash) U.S. Commerce Department Report
 - Scraps 200+ page by civil servants
 - Rewritten as a 12 page talking points memo
 - \$340k => \$28k per page
- No Serious Attempt by Government to Collect Data

How Much Work Has Moved Offshore?

- GAO:
 - “U.S. and India Data on Offshoring Show Significant Differences”
- Trade in Services Data is Poor (2003)
 - US reports imports from India: \$420 million
 - India reports exports to US: \$8.7 billion
 - **A 20X discrepancy**
- \$2 million NAPA Study
 - “Offshoring: An Elusive Phenomenon”

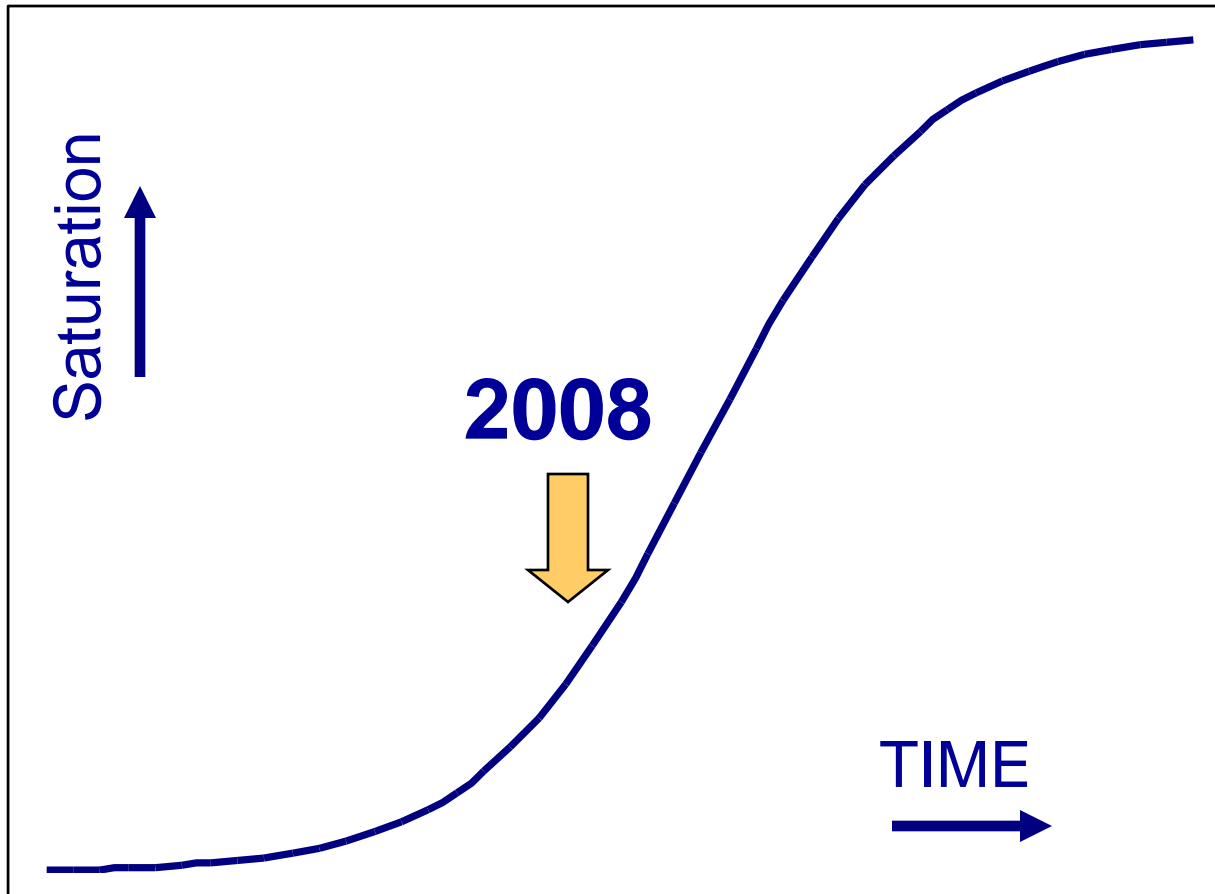
How Much Work Has Moved Offshore?

- High Skill/High Wage Work Is Moving
 - Not a simple division of labor
- It is Accelerating in Scale & Scope
 - Moving from pilot stage to large deployments
- **Poor Labor Market Signals**
 - **Need to know:**
 - What is going and what is staying
 - **Educators using mostly guesswork to redesign curriculum**

Companies Know ... BUT

- Will Not Reveal What is Happening
 - Manage Public Relations
 - Best Employees May Leave
 - Still Need US Workers to Train Foreign Replacements
 - “Knowledge Transfer”
 - Don't Want Customers to Know
- An Opportunity for This Group?

Outsourcing Saturation Just the Beginning



Wide Variety of High Wage Jobs Have Moved Offshore

“Any Task That Can Be Sent Down A Wire”

- Accounting
- Software
- News Reporting & Editing (VOA)
- Legal
- Architecture
- R&D
- **VC Firms Pushing Engineering Design**
- Insurance Claims Processing
- Radiology
- Call Centers
- Financial Analysis
- Animation

How Much Work Will Move Offshore?

- Princeton Univ's Alan Blinder
 - ~40 million (~1/3) of all jobs are “vulnerable” to offshoring
 - Not all will go, but some will and most will face new wage competition
 - Education does not make one immune
 - Face to face contact makes jobs sticky
 - Barbers, Surgeons - safe
 - Computer programming, Accounting – watch out
- Other Studies Do Same Exercise Using Different Methods
 - Kletzer/Jensen - Peterson Institute of Int'l Econ
 - Bardhan/Kroll – UC Berkeley
 - Atkinson – Progressive Policy Institute

Some Announcements

- Intel
 - \$1B in India
 - 80% for Engineering and 20% for VC
 - \$2.5B 300mm Fab Facility in China
- Microsoft Investing \$1.7bn in India
 - Headcount from 4k to 7k in India by 2008 (>10%)
- CISCO Investing \$1bn in India
 - For Engineering Design; Not for Manufacturing
 - 20% of Sr. Executives move to India by 2010

Recent Announcements

- Dell to Double Headcount in India to 20k Over Three Years
 - Compared to 26k headcount in US now
- EDS Accelerating Low-cost Headcount Target to 45k from 20k
 - Purchased MPhasiS – “inorganically” grow low-cost headcount
- Accenture’s Headcount in India Surpasses US in Aug 07
 - Will have 35k in India vs. 30k in the US

Announcements

- IBM Consolidating Key Software Processes (SOA) in India –
 - \$6 billion investment announced at annual meeting held in Bangalore
 - Headcount in India
 - 6k in 2003 to (~2% of worldwide headcount)
 - 23k in 2004 to (~7%)
 - 39k in 2005 to (~13%)
 - 55k+ in 2006 (~18%)
 - 74k in 2007 (~23%)
 - 100k by 2010
 - Cutting in US and Western Europe

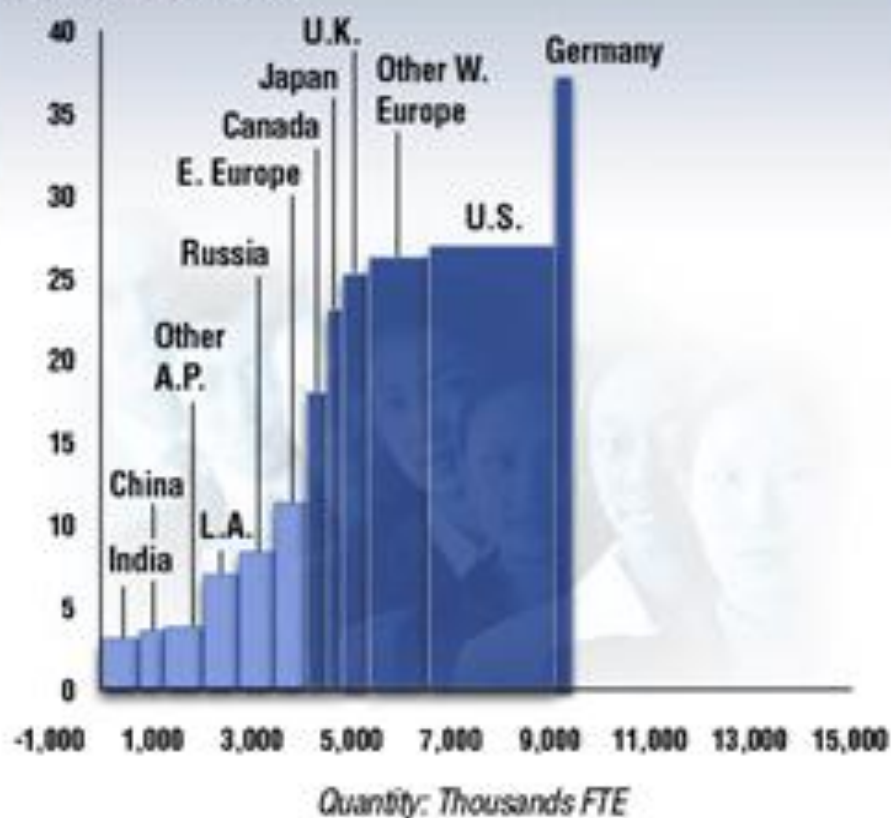
Globalization expands the pool of skilled workers

India and China have the most cost effective developer pools ...

...which will expand 3-fold by 2010

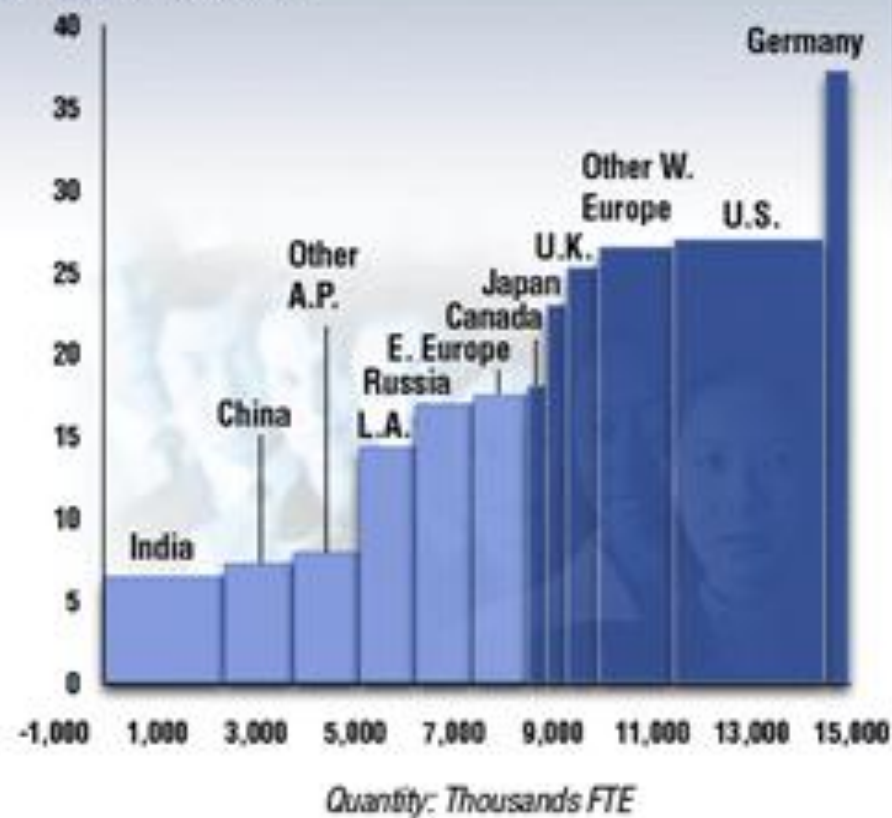
2005

Labor costs, \$ per hour



2010 est.

Labor costs, \$ per hour



Source: IDC; MGI Labor Database; McKinsey analysis; IBM analysis

Announcements

- JP Morgan Chase
 - Doubling India staff by 2008 (+ 4,500); ~1/3 global back office
- Wachovia
 - 3,000 IT jobs in Charlotte to be offshored
- Citigroup
 - Shifting ~10,000 jobs to low-cost destinations
 - Some within the US, others overseas

Developing Countries

Target R&D

- Singapore - \$2billion 'Biopolis' - Biotech
 - Also targeting Optoelectronics – HP & Agilent
- China –
 - Requires high-level tech transfer as part of investment
 - Attracting recent PhD grads of US universities
 - Companies locate R&D closer to production
- India –
 - Wants to be the “Global R&D Hub”
 - Drug Discovery and IT R&D
 - Google, Microsoft, Texas Instruments, Intel, GM, etc. etc.

Future Trends: Case of IT Services

Emerging Global IT Services Business Model

- Offshore Outsourcers Are Market Leaders
- Indian-Based IT Companies Trying To Capture US Customers – ***Not US Workers***
 - Gaming Immigration Loopholes for Competitive Advantage
- Traditional IT Services Companies (IBM, EDS, CSC, ACS) Adopt Offshore Business Model
- ***In a Matter of 3 Years, the Whole Sector Was Transformed by Outsourcing***

Emerging Global IT Services Business Model

<u>Name</u>	<u>HQ</u>	<u>Market Cap</u>	<u>Latest FY Sales</u>	<u>Profit Margin (5 yr Avg)</u>
Infosys	India	\$19,877	\$1,592	27.93%
Wipro	India	\$15,268	\$1,627	20.59%
Electronic Data Systems	US	\$12,517	\$25,865	2.74%
Computer Sciences Corp	US	\$10,015	\$14,059	3.23%

Dollar figures in millions; Retrieved from Reuters.com on November 13, 2005

The Results – EDS CEO

“EDS says offshoring great for profitability, promises to continue (Interview with Ron Rittenmeyer, EDS chairman) ”

Electronic Data Systems (EDS) Inc. says its outsourcing strategy is saving it big bucks and announced plans to continue with it through 2008.

“It's not just a passing fancy,” Rittenmeyer told ITBusiness.ca. “It is a pretty major change that is going to continue. If you can find high quality talent at a third of the price, it's not too hard to see why you'd do this.”

“We're very agnostic about specifically where we operate,” says Rittenmeyer.

- Source: *IT Business Canada*, Apr 23 08

Impacts

Economists Debate Trade Theory

- Nobel Laureate Paul Samuelson, MIT
 - Bhagwati and Irwin are promoting “polemical untruths”
 - Plausible scenarios when China’s development makes US standard of living go down
 - **Key point – outcomes are uncertain**

Economists Debate Trade Theory

- Jagdish Bhagwati, Columbia
 - Samuelson is misunderstanding outsourcing
- Alan Blinder, Princeton
 - Outsourcing is an economic transformation equivalent to the Industrial Revolution
- Ralph Gomory
 - Globalization \neq Free Trade
 - Globalization is productivity shifts plus trade
 - Trade theories do not apply

Gomory's Testimony

U.S. House of Rep. Jun 12 07

“When the U.S. trades semiconductors for Asian t-shirts, for example, that is trade in the narrow sense. And the conclusion of the most basic economic theories is that this exchange clearly benefits both countries. But when U.S. companies build semiconductor plants and R&D facilities in Asia rather than in the U.S., then that is a shift in productive capability, and neither economic theory nor common sense asserts that shift is automatically good for the U.S. even in the long run.”

Predicted Impacts

- Aggregate Labor Market Clears
 - Total number of US jobs: $f(\text{population}, \text{labor force participation})$
 - Unemployment rate is set by fiscal and monetary policies
 - Trade has little impact on the aggregate job market
- Job Dislocation At Micro-level
 - Hope for quick reemployment

Predicted Impacts

- Change in Mix of US Occupations
 - US workers move to non-tradable occupations
- Economic Theory Does Not Account For
 - Technological innovation (a residual in models)
 - Related to productivity shifts referred to by Gomory
 - National security

Both Positive & Negative Impacts

- US & Developing Countries
 - Both gain from offshoring
 - Both lose from offshoring
- Net Effects Are *Impossible* To Determine
- Impacts Are Unevenly Distributed
 - Workers bear most of the costs

Ideal Scenario:

New Mix of Occupations (Industries)

Before Offshoring

- US Workers do
 - **A**, **B**, **C**
- Offshore Workers are
 - Idle

After Offshoring

- US Workers do
 - **B**, **C**, **D**
- Offshore Workers do
 - **A** and some of **B**

Jobs Moving Overseas

Predicted Impacts

- Job Dislocation (Move from ABC to BCD)
 - **Hope for quick re-employment**
- Reality: 5.3 Million Workers Displaced (For All Reasons) Between 2001-03
 - **35% remained unemployed in Jan 2004**
 - **57% who got jobs took pay cuts**
- Ability to Absorb Losses Depends on Replenishing with Creation of *Quality* Jobs
 - Many jobs moving overseas pay *high wages*

Shift in Mix of Industries & Occupations

- Does Manufacturing Matter? ~14% of GDP
 - 43% of engineers work in mfg
 - 62% of R&D is done by mfg sector
- Does Software Matter?
 - Heart of much product development
- Should We Have Industrial Policy?
 - National? Regional?

Implications for
Engineers,
Students &
Educators

Expected Impact on Engineering

- Pluses: Expanding Markets Here & Abroad
 - New opportunities from emerging markets
 - Lower input costs expands demand for those products and services
- Minuses: Labor Substitution
- No Good Data
 - Trade doesn't count jobs
 - Large goods trade deficit
 - Services data poor
 - Net appears to be inhibiting demand for US engineers

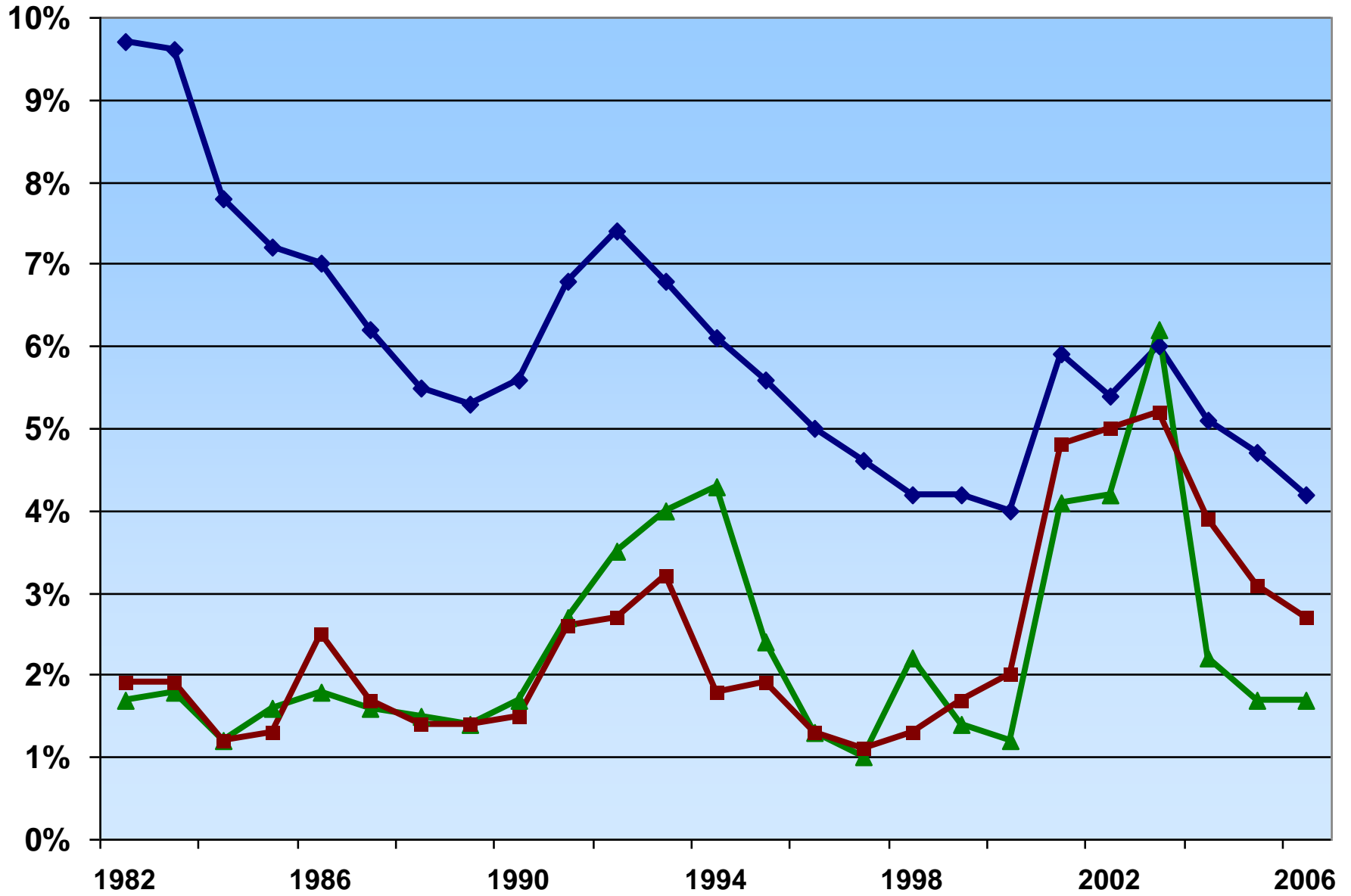
Disciplines Not Created Equally

- Change in “Mix” of Engineering
 - What is Geographically Sticky?
- Demand Driven by More Factors Than Offshoring
 - Chemical Engineering used to be based on oil prices
 - Civil Engineering based on construction spending
 - Aerospace Engineering in high demand
 - Defense spending; No hiring for decade; Boeing
 - Electric Power Industry - Demographics
- **Technological Breakthroughs Create New Opportunities & Jobs**

US Engineering Labor Market

- Stability
- Nurturing Employment Relations
 - IBM's Lifetime Employment Until 1992
- Risk Absorbed by Employers
- Investing in Employees
 - Training
 - Career Path
- Speed of Technological Change Manageable

Unemployment Rate Selected Occupations: 1982-2005



◆ All Workers ▲ Electrical Engineers ■ Computer Scientists

US Engineering Labor Market

Stability

- Volatility

Nurturing Employment Relations

- Fate of US Workers No Longer Factor in Corporate Decision-Making
 - CEOs not compensated based on number of workers (US or other)
 - Want “flexibility” to rebalance labor input mix
 - E.g., IBM forcing US workers to train foreign replacements as condition of severance

New

US Engineering Labor Market

Risk Absorbed by Employers

- Risk Transferred to Employees

Investing in Employees

- Employees Should Invest in Themselves (“on their own dime and time”)

Speed of Technological Change Manageable

- “Half-Life” of Engineers Decreasing

Geographic Advantages for US Engineers Diminish

Preferred Access to Latest Tools & Technologies

- Companies Take Latest Tools & Technologies to Foreign Talent
- Tools & Technologies Often Embedded in Software - Much More Mobile

Access to and Knowledge of Most Sophisticated Market

- Companies Manage Knowledge Flow
 - Facilitated by communications technologies
- Foreign Markets Growing Faster Than US Markets
 - More Sophisticated (?) - Technology leapfrogging

Geographic Advantages for US Engineers Diminish

Best Infrastructure

- Developing Countries Investing in Infrastructure
 - Intangible infrastructure - intellectual property rights?
- Importance of Infrastructure Diminishing

Preferred Access to Best Universities

- US Universities Go Global
 - Take latest education to foreign students
 - Franchising
 - Research labs
 - Leaders view their institutions as global resources – both public and private

Geographic Advantages for US Engineers Diminish

Capture Best & Brightest Foreign Students/Workers

- Cheaper to Train Foreign Students In-Country Than Import Them at Graduate School
 - Education at Indian Institute of Technology (IIT) is 1/10th cost of US engineering education
- US Trained Foreign Students Have More Opportunities When They Return Home
 - Brain circulation
- Employment Based Green Card Process is Broken

Geographic Advantages for US Engineers Diminish

Companies Reluctant to Use Overseas Talent

- Companies Substitute Foreign for US Workers
 - By shifting tasks overseas
 - By importing foreign workers on H-1B and L-1 visas
 - Forced knowledge ‘extraction’
 - Must train replacements as condition of severance
 - Workers no longer a stakeholder

R&D Labs in US

- Offshoring Production Attracts Design and R&D

Student Choice & University Education

- Poor Labor Market Signals Constrain Decisions
 - Educators and workers flying blind
- Students Steering Clear of Any Discipline w/ “Computer”
- Educators Adapting
 - Electrical E & Computer E programs integrating Bio-
 - GA Tech Comp Science changes curriculum
- How Do We
 - Make Workers *Durable*
 - Continuing & Life-long learning
 - Make Workers *Resilient*
 - Bounce back from layoffs

Firms Training Engineers in Low Cost Countries

- Widespread Programs to Recruit & Train
 - Many smart non-technical people trained
- IBM Sets up IT Service Outsourcing Talent Pool in Nanchang (Source: SinoCast)
 - IBM will help train 100,000 professional offshore service outsourcing professionals in Jinagxi within five years
- “Cisco plans to recruit, train 360,000 Indian engineers” (Source: NSPE)
- Are Companies Putting Same Resources Behind US Engineers?

Universities Go Global (Multinational)

- Universities “Venture Abroad”
 - Building campuses in low cost countries
 - Huge potential # of customers in India and China
 - Outposts for U.S. faculty & students
- “Cornell Courts a Subcontinent [India]”
 - Mission stmt – “First Transnational University”
- Does This Help US Students & Workers?
 - Training collaborators or competitors?

New vs. Old
Competitiveness
Debate

New vs. Old

Competitiveness Debate

- Old
 - US companies in auto, steel, & semiconductors losing market share
 - US workers losing jobs
 - Workers and companies aligned
- New
 - US companies doing fine
 - Companies suffering will adopt offshoring business model
 - Companies now competing US workforce vs. foreign workforce

Corporate Leadership Under *Old* Competitiveness Debate

- Go to DC to Change Policy Course
 - John Young, CEO of HP “Young Commission”
 - Bob Noyce, Intel
- Complaints About *Unfair* Japanese Practices
- “Voluntary” Restraint Agreements (Quotas)
- Guaranteed Minimum Market in Japan
- Industrial Policy Under National Security Banner

Corporate Leadership Under *New Competitiveness Debate*

- Craig Barrett – “Do No Harm”
 - Maintain status quo
- Carly Fiorina ex-CEO of HP
 - "There is no job that is America's God-given right anymore"
- Vinod Dham, Venture Capitalist to Semiconductor Chip Designers
 - “You need to stop whining”

Pundits

- Lou Dobbs
 - Squeezing the middle class
- Robert Reich
 - “High-tech jobs are going abroad, but that’s ok”
- Thomas Friedman
 - “I don’t believe any well qualified software engineer is unemployed.”
 - “Lou Dobbs is making people stupid”
- George Will
 - “The economics of progress”
- NY Times & Wash Post Editorials
 - Supportive of Greg Mankiw’s comments

New vs. Old

Competitiveness Debate

- Policy Mechanisms Oriented Towards Boosting Companies
 - R&D subsidies: Sematech
 - Defense procurement
 - R&E tax credits
 - Education subsidies
 - Sunrise industries: Nanotechnology R&D, Bayh-Dole, ATP, etc.
 - Improving manufacturing quality

New vs. Old

Competitiveness Debate

- 21st Century Policy Mechanisms That Are Geographically More Sticky
 - ?
 - Human Capital oriented?
 - Infrastructure?
 - Computing?
 - Transportation?
- Discussion We Should Have
 - Will Take Time & Creativity
 - Government Not Helping Anytime Soon

Choices Being
Made

The Washington Consensus

- National Academy of Sciences (NAS) Rising Above Gathering Storm
 - Origins from Council on Competitiveness
 - IBM funded National Innovation Initiative in Oct. 2003
 - Diagnosis – *Undercapacity*
 - Tom Friedman – Popularizes Ideas Before & After Report
 - Solutions – Need More
 - More R&D spending
 - More Sci & Tech Workers (Domestic & Foreign)
 - More & better K-12 Science & Math Teachers
 - NAS Committee had no one representing interests of American workforce

The Washington Consensus

- Moratorium on Free Trade Agreements Until
 - Add Labor & Environmental Standards
 - Increase Trade Adjustment Assistance
 - Extend to services workers
 - More generous
- BUT – Services Trade is Mostly Outside of These Trade Agreements
 - So, fixing the FTAs does nothing for white-collar outsourcing

Policy Options

What Can We Do About Offshoring?

- Goal
 - Make US workers 5-8X more productive than their foreign counterparts
 - Must be done through differentiation of services
- Not Everything Will Go
 - Need to focus efforts on how we build up geographically sticky advantages

What Can We Do?

- Acknowledge a Problem Exists
 - Denial in ranks of the elites
 - Academic elites, media elites, business leaders
 - Interests of Companies & Countries diverge
- Measure What is Happening
 - Science is based on observations – how can we have a rational conversation without some data collection?
 - Figure out which jobs are sticky vs. vulnerable

What Can We Do?

- High Skill Immigration Policies Are Making Matters Worse
 - Bill Gates is misleading you
 - Guestworker visa (H-1B & L-1) have major loopholes resulting in the speeding up of outsourcing
 - 8 of top 10 H-1b employers are outsourcing firms that are transferring work overseas
 - Fix these loopholes
 - For more information see my article in The American Prospect from August 2007.

What Can We Do?

- Make Smarter Choices About Government Procurement
 - There are spillover benefits from government procurement such as building the capacity of firms and workers
 - Microsoft's first headquarters was in Albuquerque, NM to be close to US Dept of Energy Labs
 - EDS & Social Security
 - Boeing – Civilian Aircraft

What Can We Do?

- Overhaul Assistance Programs for Displaced Workers
 - Extend to services workers
 - Fully fund
 - Be very wary of wage insurance
 - Way to bribe workers to accept lower-skill jobs – downward mobility
- Ensure No Worker Has to Train Their Foreign Replacement Under Duress
 - Eliminate muzzle provisions in separation agreements

What Can We Do?

- Rethink Government Role in Learning & Education
 - K-Gray responsibility
 - Firms have cut tuition reimbursement
 - Make Workers *Durable*
 - Continuing & Life-long learning
 - Make Workers *Resilient*
 - Bounce back from layoffs

What Can We Do?

- New Institutions Need to Be Created to Represent Workers' Interests
 - Unions have done a remarkable job BUT
 - ~7.4% of the private sector workforce
 - Large numbers of workers will not join unions
 - Is there a new membership model?
 - Professional societies go global
 - Abandoning interest of US members in favor of growth regions, and represent interest of elites (Academics)

What Can We Do?

- Maintain Technological Leadership
 - Measured not by HQ location of the MNC but instead by actual work done in US by American workers
- Design Trade Policies in the National Interest

Your Questions