The Emerging Software Economies and the United States

Ashish Arora

Heinz School

Carnegie Mellon University

Sloan Industry Studies Annual Meeting
April 19-21, 2004 – Atlanta, GA

US Software Jobs: Mostly outside the IT industry; So is most of the IT outsourcing

Industry	Employment
Computer Equipment	72
Computer and Software Services	977
All Other Industries	2816
Total	3865

Source: BLS, 2001

Software Employment as a Share of Total Employment, 2001

Software Exports and Imports ($Millions)

	Exports	Imports	Imports From India
Data Processing, Database, and Other Info Services	5430	1293	80
Royalties	37,042	613	1
Intra-firm Trade	1,500	2,900	

Official Statistics Are Clearly Missing Something

Source: BLS, 2001

The software industry, selected countries (2001)

|	Sales, $ B	Sales/ GDP	Exp, $ B	Emp '000s
US**	200	2.00%	--	1042
Japan*	85	2.00%	0.073	534
Germany	40	2.20%	--	300
UK	15	1.00%	--	--
India	8.2	1.70%	6	350
Ireland	7.6	7.40%	6.5	25
Israel*	3.7	3.40%	3	35
Brazil	7.7	1.50%	0.1	158
China	7.4	0.60%	0.4	186
Korea	7.7	1.80%	0.035	--

Source: Botelho et al (2005)

The "I" Countries: A comparative advantage in human capital

- Modest economic performance between 1970-1990
- high investment in human capital relative to domestic needs
- But different ways of exploiting their comparative advantage

	India	Ireland	Israel
Domestic firms	Services; maintenance, solutions	Niche mkt consulting; Some product	R&D based products: telecom, security
Sector Focus	Limited	High	High
Growth	Export based	MNC and export based	Leverages domestic mkt for export
MNC	Prod devp; Services	Localization	R&D
Industry Business Model	Large service firms;	Business solutions – products and service	Silicon Valley – VC finance, NASADQ listing
GDP per capita growth 197-90 (% of avg growth in peers)	2.02% (64%)	2.97% (65%)	2.39% (53%)

Source: Botelho et al (2005)
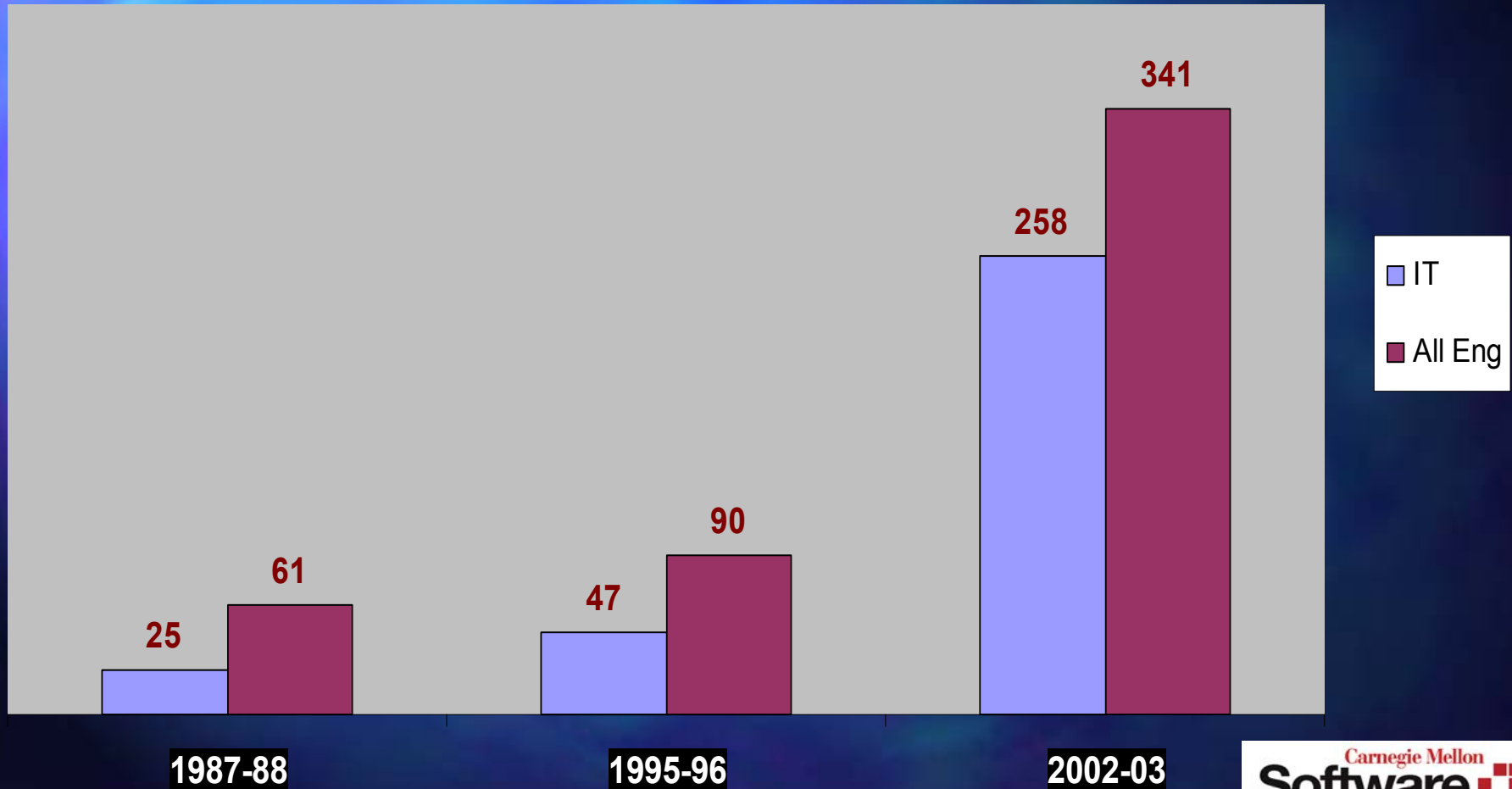
Drivers of Offshoring

Falling Telecom Costs

- **Fiber-optic capacity connecting telephones into India increased 7-fold between 2001-2002**
- **Dedicated phone/data line now costs 1/4 what it did 2 years ago ($11K/month)**
- **Capacity into India is expected to double again this year.**
- **US experienced a fiber-optic glut in the late 90s. Prices fell 50% in 1998, and 80% more since then.**

Abundant and Cheap Skills Overseas

- **Large increases in trained engineers in India, Brazil, China**
- **Pools of highly trained engineers and scientists elsewhere (e.g., Israel, Ireland)**
- **Labor costs ~50% or lower**

Is outsourcing SW good for US?

- **This is not the first industry to globalize**
  - ✓ Static trade theory – free trade is unambiguously better than alternatives,
  - ✓ "winners" ought to compensate "losers
  - ✓ Wage differential is declining
- **SW production -- coding and maintenance – outsourced**
- **Design, product devp. not outsourced.**
  - ✓ Coordination and communication (even e-mail) is demanding;
  - ✓ Face to face meetings still necessary, implying lengthy travel

Is higher productivity of Indian SW good for US?

- **Productivity increase in India in sectors that US exports *could* hurt US**
  - ✓ Hicks; Dorfmann, Fischer Samuelson; Gomory and Baumol
- **Outsourcing to India *could* hurt US in the longer term as it increases Indian SW productivity**
- **BUT unlikely because of the large differences in income levels.**

Will the "labs" follow the "mills"?

- **SW Production is moving offshore; R&D is still onshore**
  - ✓ **Firms need to maintain geographical proximity to their customers,**
- **Will innovation also eventually move offshore?**
  - ✓ **Some firms are setting up R&D centers overseas to tap talent and lower costs**
  - ✓ **Analogies to televisions and other consumer electronics**

Unlikely to be a major problem

1. **R&D and production can be separated for extended periods**
   - – **e.g., Lamoreaux and Sokoloff; Sutthiphisal**
2. **Large inflow of high end human capital.**
   - o **engineering grad students from overseas.**
3. **US remains major market. New product development needs to be close to market and to lead users**
   - o **Many Israeli, Irish and Indian firms relocate to US**

Selected Foreign Born Populations in the United States Aged 25 and Over

	1990	2000	% Chng	% of 2000 population entering post 1990	Educational Attainment (2000)		
					Primary %	Second. %	Tertiary %
India	304	837	175	55	5	15	80
Brazil	54	154	186	49	9	36	55
China	405	847	109	66	20	26	54

Characteristics of the US-Born and Selected Foreign-Born Populations in the United States by Year of Entry (2001 March CPS)

	Indian-Born	Irish-Born	Israeli-Born
Before-1960	1%	32%	4%
1960-1969	3%	19%	1%
1970-1979	14%	8%	28%
1980-1989	24%	23%	35%
1990-1995	23%	13%	18%
1996-2001	36%	5%	14%

Source: Kapur and McHale, 2005 based on Census 2000

Summary

- **US software is a large industry that employs workers all over the country.**

- **Low wages and cheap communications driving offshoring**

- **Design, product development, marketing and implementation less likely to move offshore – proximity is key**

- **U.S. remains the largest market and is increasingly a major attractor for talent and ideas**

- **Other countries (Europe? Japan?) have more to fear from globalization than the United States.**