

**Prospects for
US Manufacturing and Engineering
in the Global Economy**
Sectors of Excellence, Structural Change

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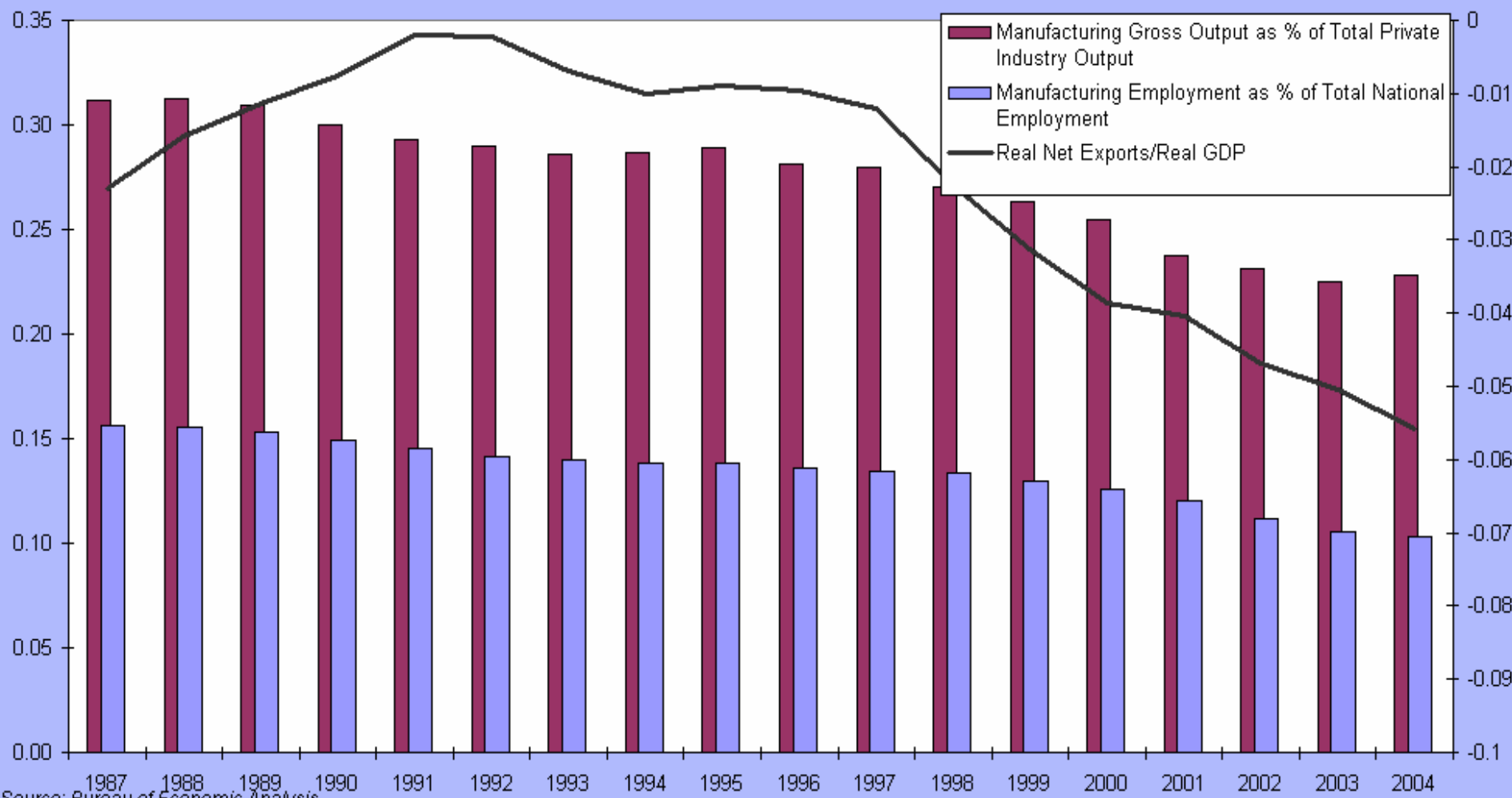
2006 MIT Manufacturing Summit
Manufacturing Research and Education in the Global Economy
April 27-28, 2006

Scary Headlines

- **“Rising Foreign Outsourcing and Employment Losses in U.S. Manufacturing”**
 - *“Manufacturing in ‘transition’”*
 - *“Decline of Manufacturing wrenches ...”*
- **The Big [middle-class] Squeeze:**
 - *A 'second wave' of offshoring could threaten middle-income, white-collar and skilled blue-collar jobs.*
 - *“Scams, Lies, Deceit, and Offshoring”*
 - *“India Gets over 50% of jobs outsourced by Silicon Valley”*
- **“Exporting Expertise, If Not Much Else”**
 - *OUTSOURCING INNOVATION: Are these companies going too far?*

Scary Data

Manufacturing Output, Employment, and Total Trade

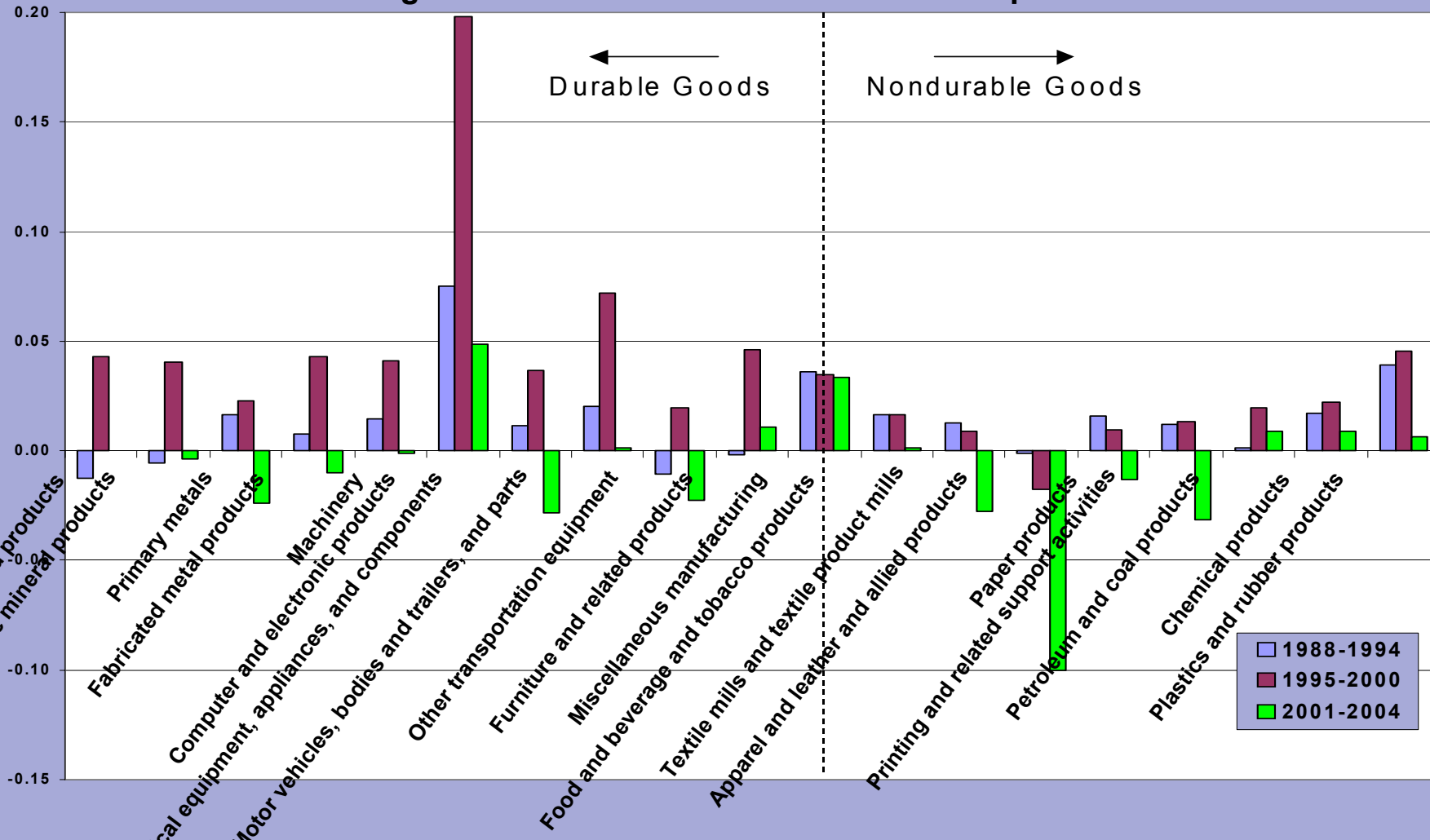


2006 is better... but...

- **Engineering degrees top hiring statistics:**
 - 5 of the top 10 BAs in demand: 3 of the top 5 MAs:
Mechanical , electrical, computer sciences, chemical
- **Engineering-related sectors top demand for new hires:**
 - Engineering services, construction services, aero engineering, auto/mechanical equipment, electrical machinery, utilities
- **Engineering jobs tops in starting salaries:**
 - Aero: \$54,410; Transp. equip: \$51,610; Eng. services \$49,715
 - vs. Humanities/Soc Sci: \$31,232; Retail trade: \$34,932

Leading Domestic Mfg & Services Sectors

Average Annual Growth Rates of Output

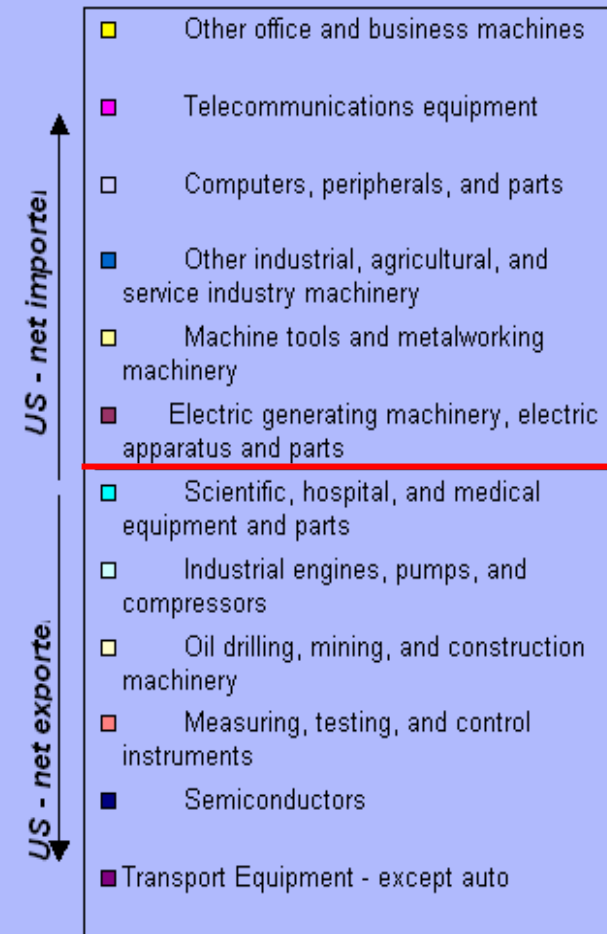
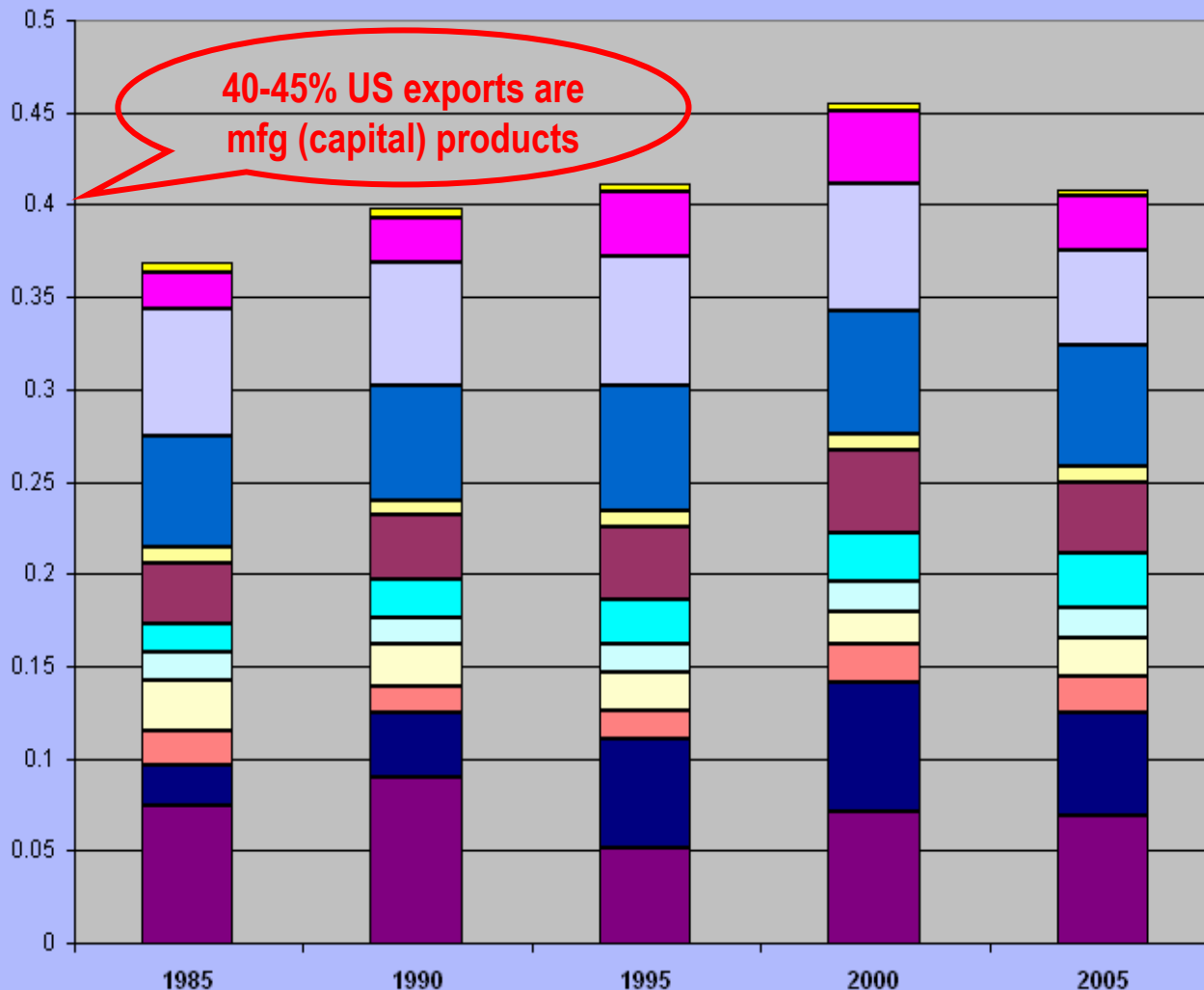


Leading Domestic Mfg & Services

Description of sector (mfg/services)	Share of sector's Y in total economy (2001-2004)	Rank, by growth, in	
		2001-2004	1998-2001
Management consulting services	0.76%	12	12
All other miscellaneous professional and technical services	0.70%	9	4
Semiconductors and related device manufacturing	0.43%	5	1
Electronic computer manufacturing	0.32%	2	3
Other computer related services, including facilities management	0.29%	21	7
Information services	0.26%	35	2
Environmental and other technical consulting services	0.17%	4	11
Electromedical apparatus manufacturing	0.10%	6	33
Buttons, pins, and all other miscellaneous manufacturing	0.09%	7	201
Motor home manufacturing	0.03%	8	431
Laboratory apparatus and furniture manufacturing	0.03%	3	79
Copper wire, except mechanical, drawing	0.02%	1	420
Software reproducing	0.00%	11	444

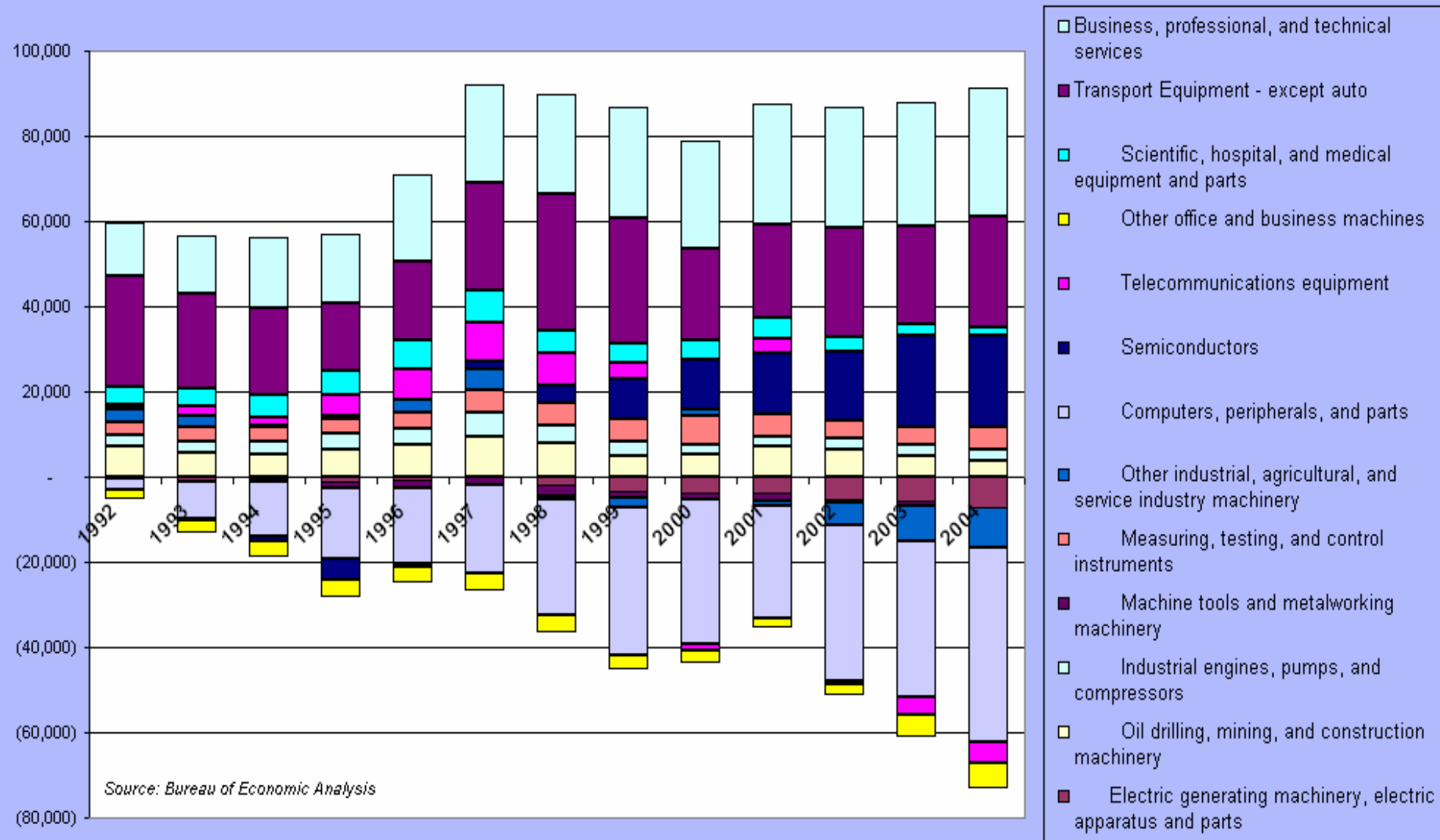
International Trade: Exports

Average export shares - by type of capital good



International Balance of Trade

US Balance of Payments: Capital Goods and Bus./Prof./Tech. Services

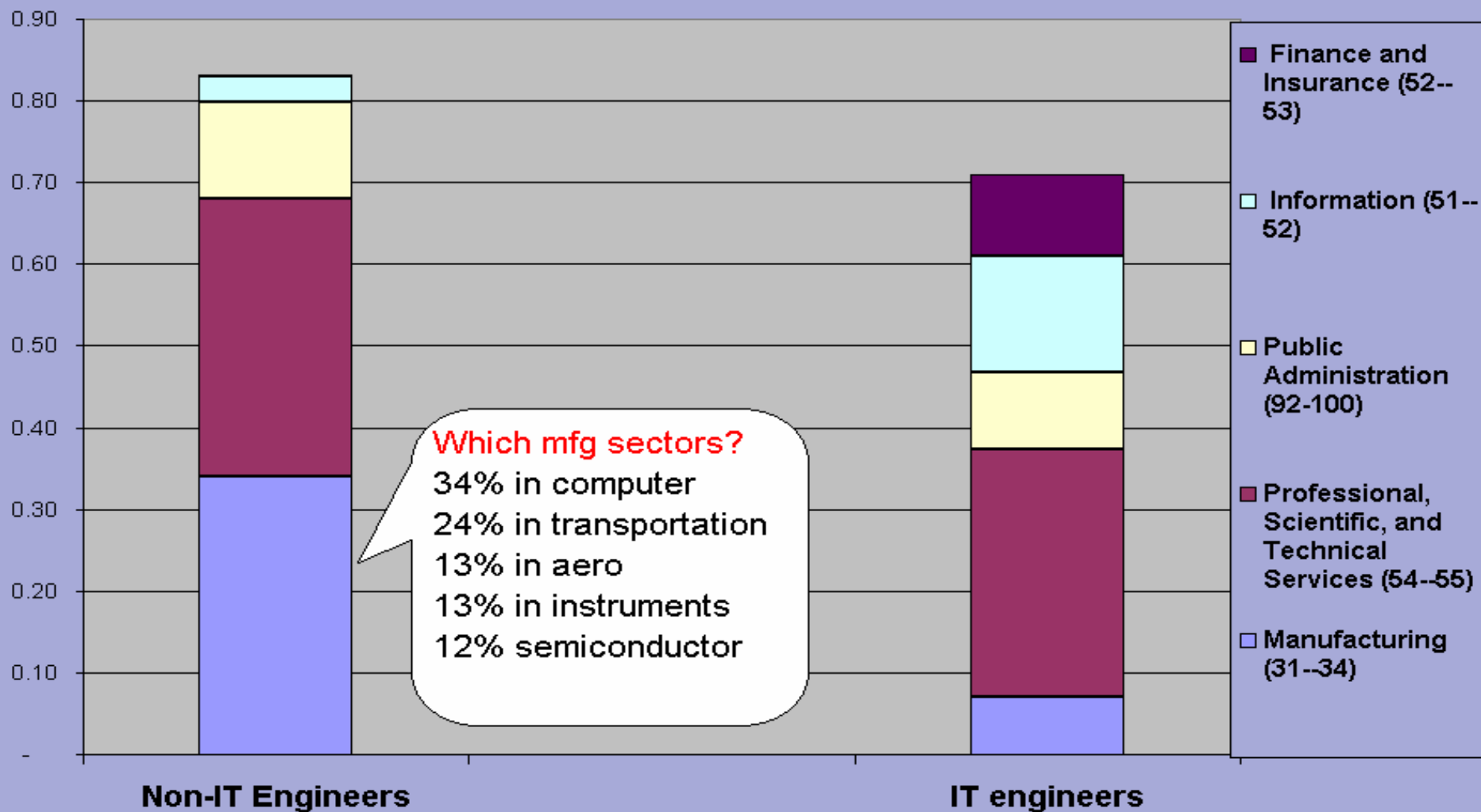


The New Engineering Labor Market

- Which sectors, which jobs (occupations)?
- Accentuated response to business cycle
- Structural change within skill groups
- Expanded management responsibilities

Engineers Diffused Throughout Economy

Sectors that Employ Engineers. 2004

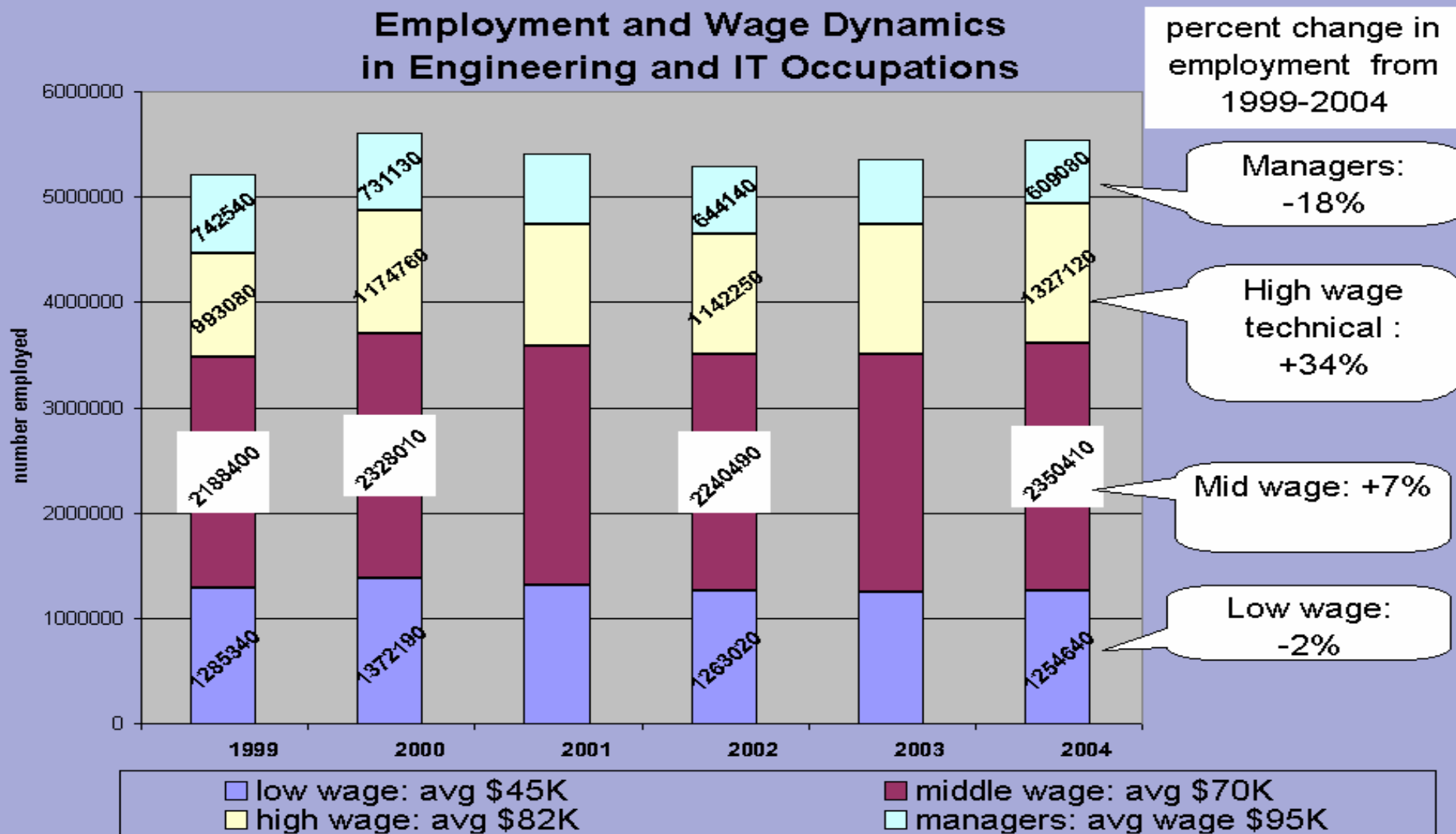


Many Opportunities (a plus) But increasing exposed to economic cycle

Unemployment Rates - By Occupation



Structural Change in Occupation Dynamics



IT a Microcosm for All Engineers

Occupations	1999	End-2004	Change		Annual Wage 2004
			Total	Percent	
Total Call-Center and Low-Wage Tech. Workers	2,241,650	1,530,560	-711,090	-31.7%	\$ 26,539
Mid-Level IT occupations: Computer Support Specialists	462,840	491,680	28,840	6.2%	\$ 43,660
Total High-wage Tech. Workers: applications, networking, analysts, database,	2,200,650	2,581,380	380,730	17.3%	\$ 71,680
<i>of which: Computer programmers</i>	<i>528,600</i>	<i>396,100</i>	<i>-132,500</i>	<i>-25.1%</i>	<i>\$ 66,480</i>
in the Manufacturing Sector				-19%	
Employment				3%	

Source: Bureau of Labor Statistics CES Data, 1999, 2000, 2001, 2002, May 2003, November 2003 and May 2004 National Occupational Employment and Wage Estimates

Engineers face business cycle, trade, and technology risks

Low-wage in real trouble—from trade & technology

Increased 'codification' puts some high-wage at risk (programming)

Increased jobs at middle & high-wage demand integrative & analytical skills

Concluding Observations

- **Aggregated data on manufacturing output masks vibrant sectors of excellence**
 - Persistent fast growers; some are large; most are specialized:
High value added-low volume
- **Aggregated data on manufacturing employment masks structural changes in engineering profession**
 - Wide dispersion of engineering throughout the economy
 - Rising responsiveness to business cycle and trade
 - Rising disparity of outcomes within profession
- **What is ‘skill’ today? What to teach today?**
 - Skill depreciates rapidly—need to update continuously
 - New “skills”: Judgment, problem-solving, communications skills
 - Frank Levy (MIT) and Richard J. Murnane (Harvard)
 - Managerial functions demanded on the technical track—but middle-managers facing skill depreciation do poorly

Forthcoming

**Accelerating the Globalization of America:
The Role for Information Technology**

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