Past Trends and Projections in Wage, Work and Occupations in the United States

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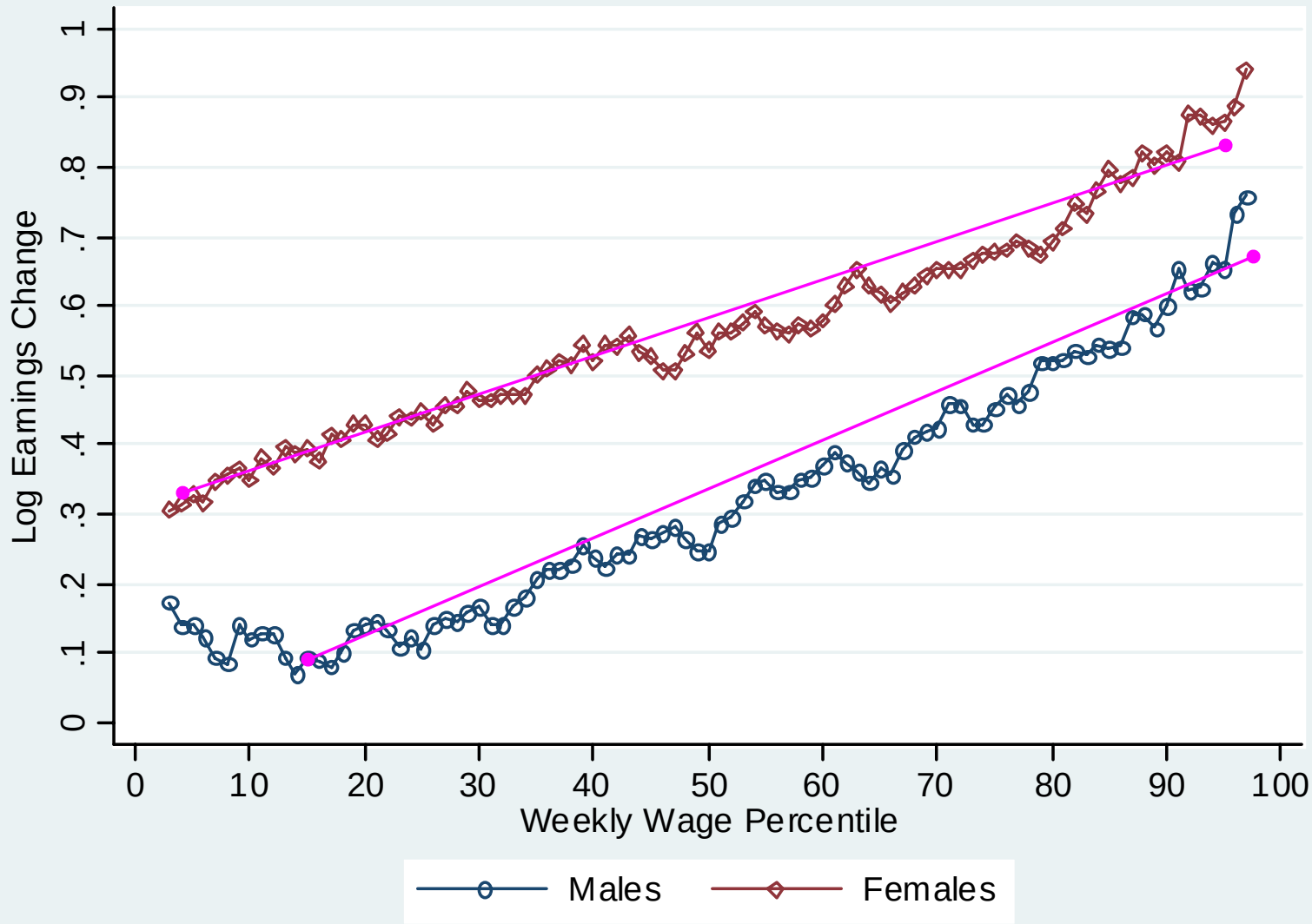
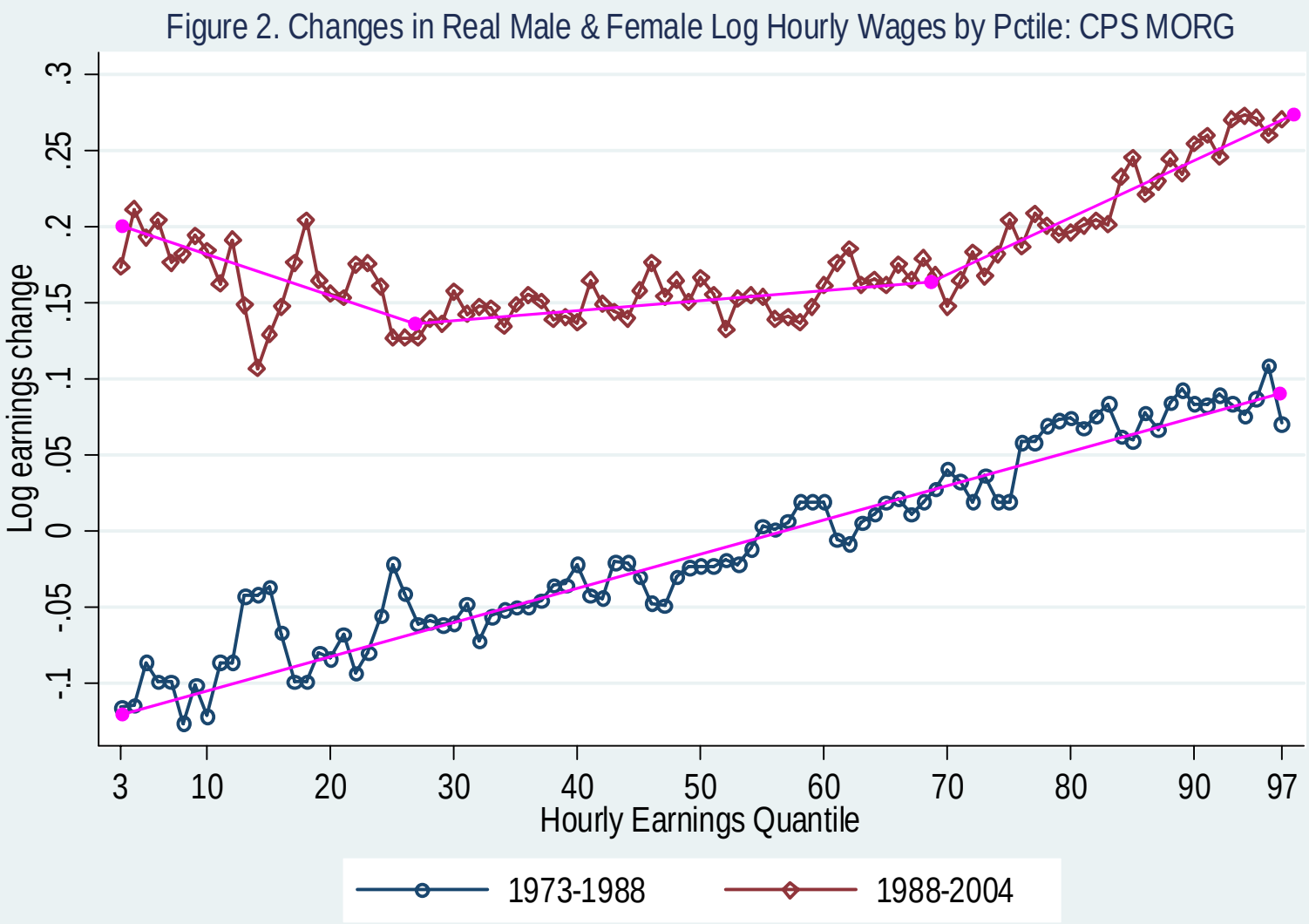
Strategies for Improving Economic Mobility of Workers
November 15 – 16, 2007

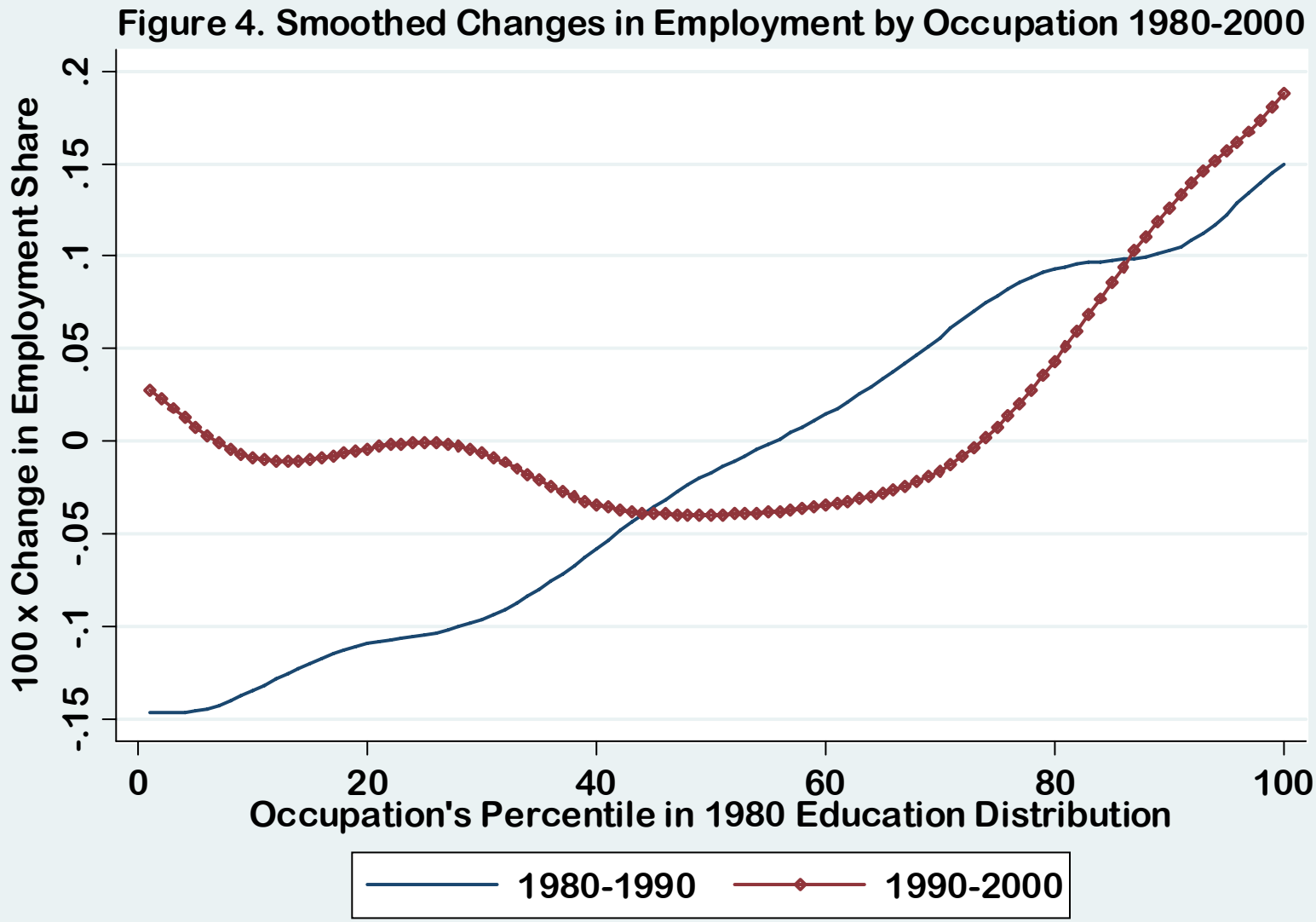
A Historic Rise in Earnings Inequality: Change in Real Weekly Wages by Percentile, 1963 –2005



Less Well Known: An Ongoing Polarization of Earnings Inequality from 1988 to Present

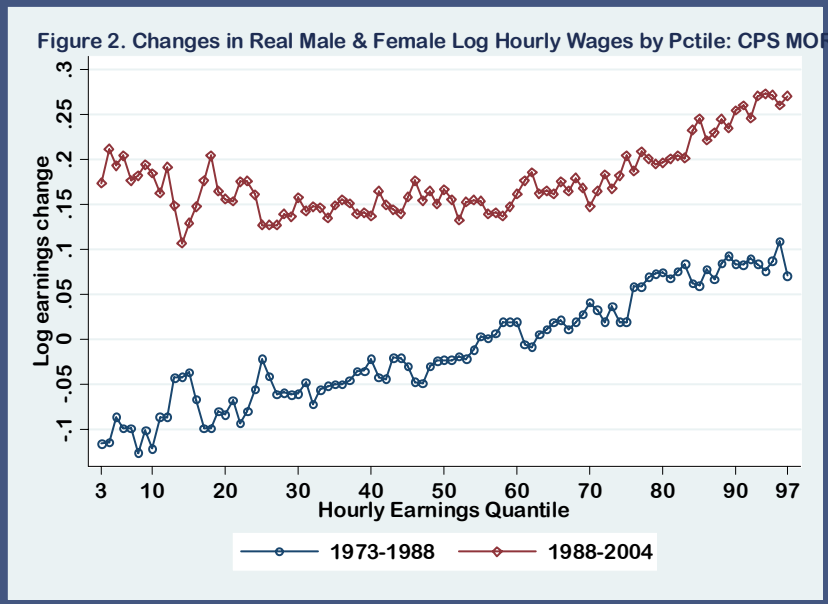


Polarization of Wages Mirrored by Polarization of Job Growth

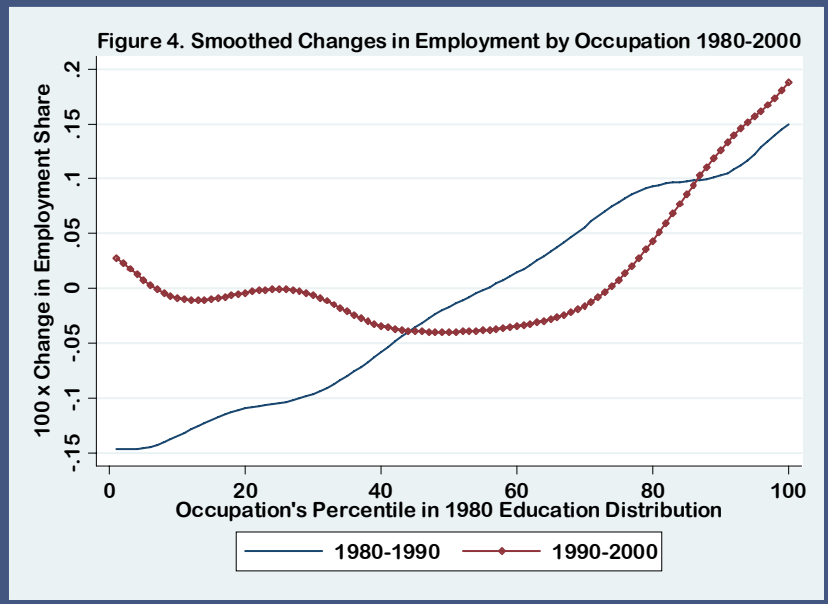


A Striking Correspondence…

Real Wage Growth by Earnings Pctile 1973-88 and 1988-04



Changes in Employment by Occs' Educ't Pctile, 1980-90 & 1990-00

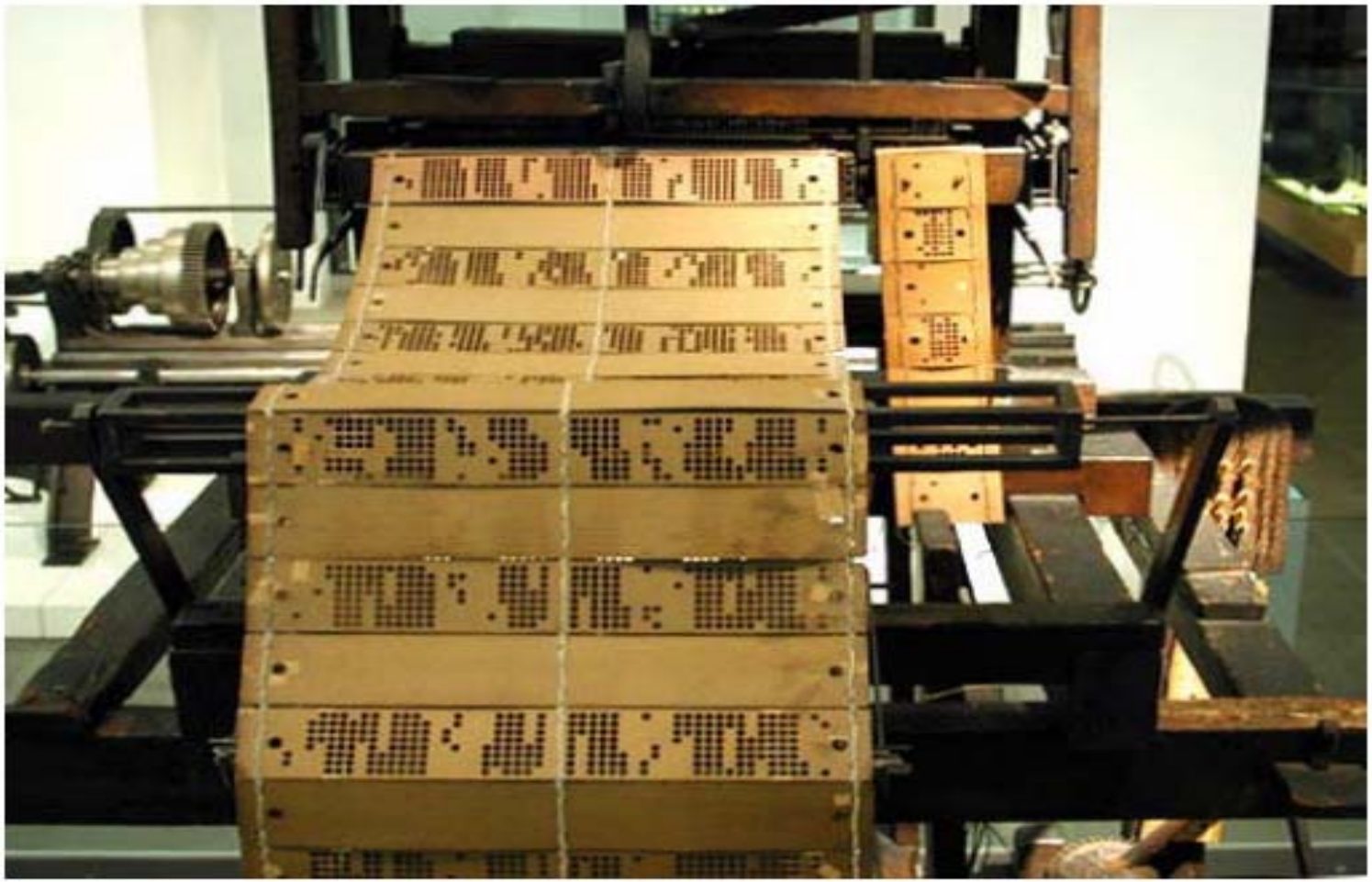


What Explains Polarization of Employment Growth?

- **A hypothesis:**
  - Autor, Levy, Murnane (2003) 'task' view of computerization
  - Conceptualize work from "computer' s point of view:"
    - Which tasks does computerization substitute/replace?
    - Which tasks does it complement?

- **Two defining traits of Computers:**
  1. "Symbolic processor," acting upon abstract representations of information: Binary numbers, punched cards.
  2. Actions deterministically specified by explicit procedures ('programs').

The First Computer



Source: Collection, Science Museum, London. Photograph by George P. Landow, June 2000; downloaded from <http://65.107.211.206/technology/jacquard2.html> (8/27/2002).

Jacquard Loom of 1801

Since 1800s, 1 to 5 Trillion-Fold Decline in Price of Computing

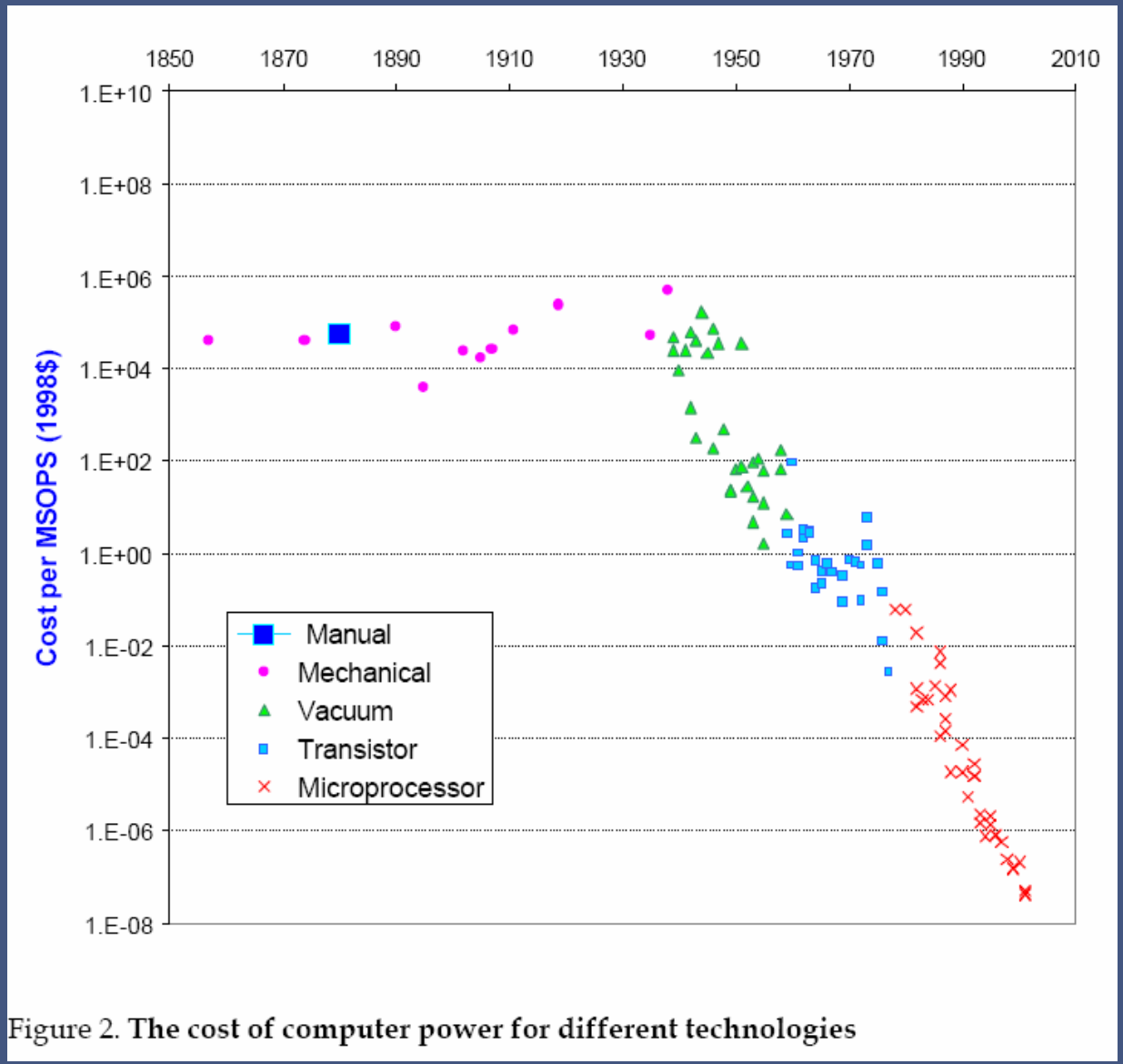
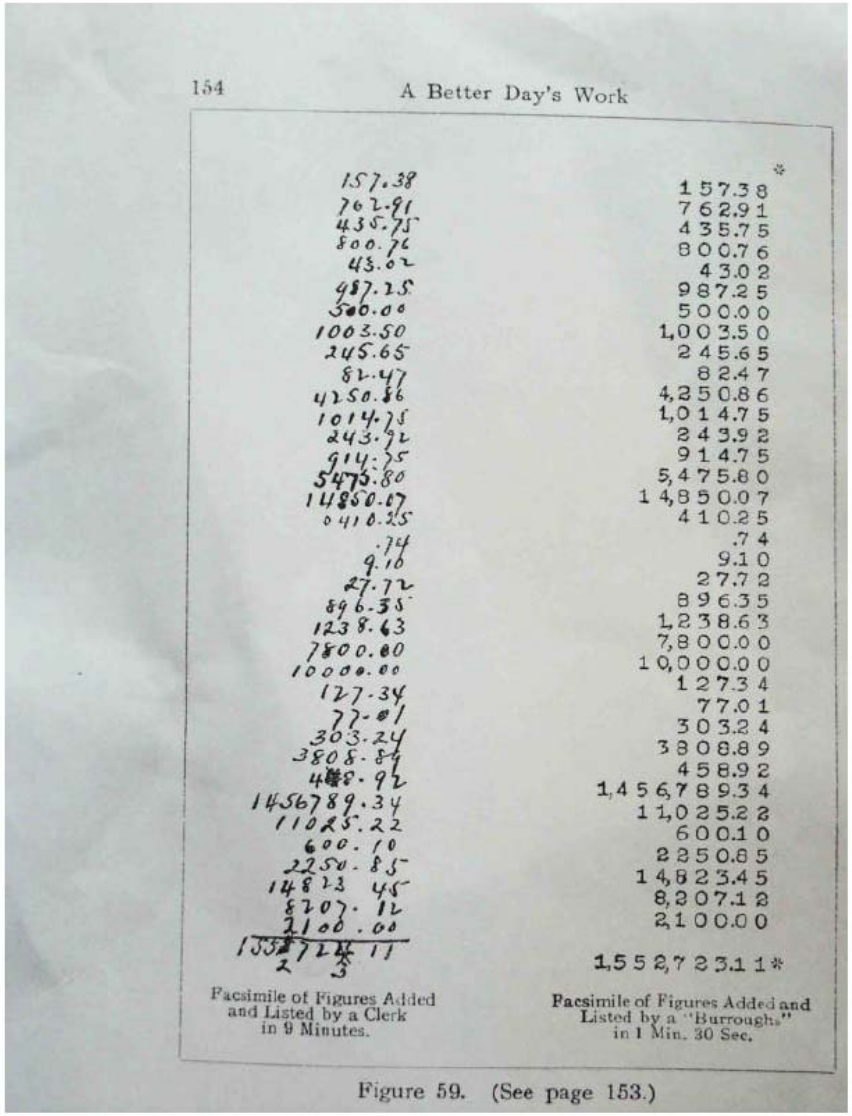


Figure 2. **The cost of computer power for different technologies**

Source: Nordhaus 2001

What do Computers do? *'Routine' Tasks*

- **A task can't be computerized unless we 'know the rules'**
  - That is, there is a *well-specified procedure* for accomplishing the task.
- **For a large set of tasks, this is not a constraint:**
  - Clerical tasks: Sorting, filing, storing, copying, calculating
  - Control tasks: Monitoring, measuring, controlling
- **Refer to these rules-based activities as 'Routine' tasks:**
  - Routine tasks are readily automated/computerized.
  - Note: What is 'routine' for computers is not necessarily routine for people. Adding a column of 1,000 numbers is routine for computers—not people.



154 A Better Day's Work

Facsimile of Figures Added and Listed by a Clerk in 9 Minutes.	Facsimile of Figures Added and Listed by a "Burroughs" in 1 Min. 30 Sec.
157.38	157.38
762.91	762.91
435.75	435.75
800.76	800.76
43.02	43.02
987.25	987.25
500.00	500.00
1003.50	1,003.50
245.65	245.65
82.47	82.47
4250.86	4,250.86
1014.75	1,014.75
243.92	243.92
914.75	914.75
5475.80	5,475.80
14850.07	14,850.07
0410.25	410.25
.74	.74
9.10	9.10
27.72	27.72
896.35	896.35
1238.63	1,238.63
7800.00	7,800.00
10000.00	10,000.00
127.34	127.34
77.01	77.01
303.24	303.24
3808.89	3808.89
458.92	458.92
1456789.34	1,456,789.34
11025.22	11,025.22
600.10	600.10
2250.85	2250.85
14823.45	14,823.45
8207.12	8,207.12
2100.00	2100.00
1552723.11	1,552,723.11*

Figure 59. (See page 153.)

Plate 1. **Comparison of Manual Calculation with Manual Calculator**

This photograph shows a comparison of manual calculators and computations by a clerk in adding up a column of numbers such as might be found in a ledger. The calculator has an advantage of a factor of six. (Source: Burroughs Adding Machine Company, *A Better Day's Work at a Less Cost of Time, Work and Worry to the Man at the Desk in Three Parts Illustrated,* Third Edition, Detroit, Michigan, 1909, pp. 153-154.)

Source: Nordhaus 2001

What don't Computers do? *'Non-Routine' Tasks*

- **But 'knowing the rules' not a trivial requirement.**
  - *"We can know more than we can tell…"* Michael Polanyi, The Tacit Dimension, 1966)
- **Two broad sets of tasks where we don't 'know the rules':**
  1. **'Abstract' tasks: Demand problem–solving, creativity:**
     - Solving novel/unstructured problems.
     - Developing and testing hypotheses.
     - Exercising discretion, managing other people.
  2. **'Manual' tasks: Requiring environmental or interpersonal adaptability:**
     - Driving a truck through city traffic.
     - Conversing in spoken language.
     - Serving a meal.
     - Dusting a room.

“Warning Will Robinson! Danger”

Task View of Computerization [Autor, Levy, Murnane 2003]

	Task Description	Example Occupations	Potential Computer Impact
Routine Tasks	• 'Rules-based' • Repetitive • Procedural	• Bookkeepers • Assembly line workers	• Direct Substitution
Abstract Tasks	• Abstract problem-solving • Mental flexibility	• Scientists • Attorneys • Managers • Doctors	• Strong Complementarity
Manual Tasks	• Environmental Adaptability • Interpersonal Adaptability	• Truck drivers • Security guards • Waiters • Maids/Janitors	• Limited Complementarity *or* Substitution

Google: The Ultimate Routine Cognitive Task

Delegating Non-Routine Manual Tasks to Workers

BUSINESS 2.0
The playbook for a new generation of leaders™

The Wearable Warehouse

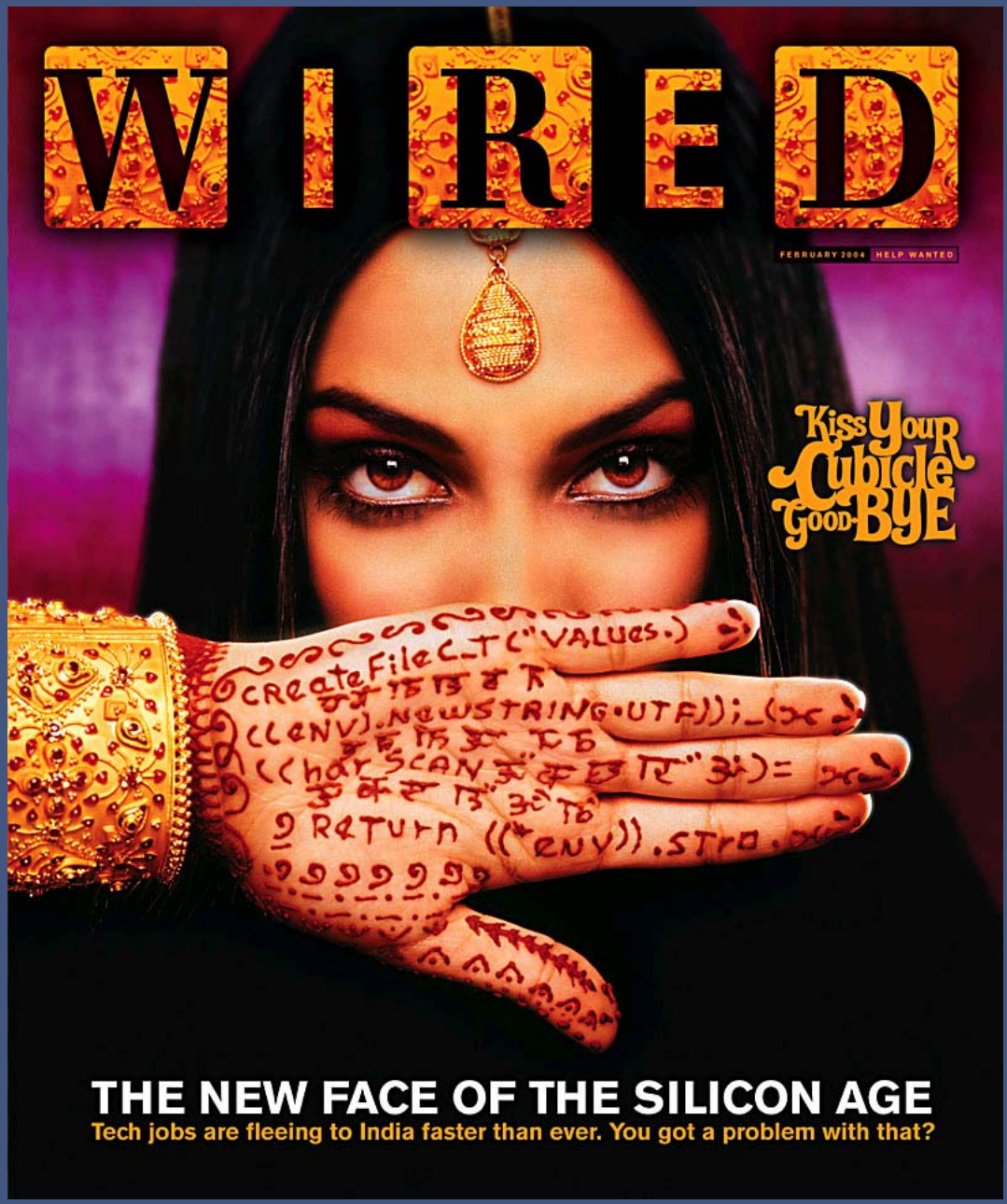
Computerized Warehouse

- **Computer is the brain**
- **Worker is hands and eyes**
- **Computer's tasks:**
  - Maps quickest route to item
  - Direct worker to bins
  - Manage inventory
- **Worker's tasks:**
  - Walk to bins
  - Retrieve items
  - Scan items so computer can verify correct pickup
- **If asked by computer:**
  - Count what's left in bin
  - Tell computer via microphone

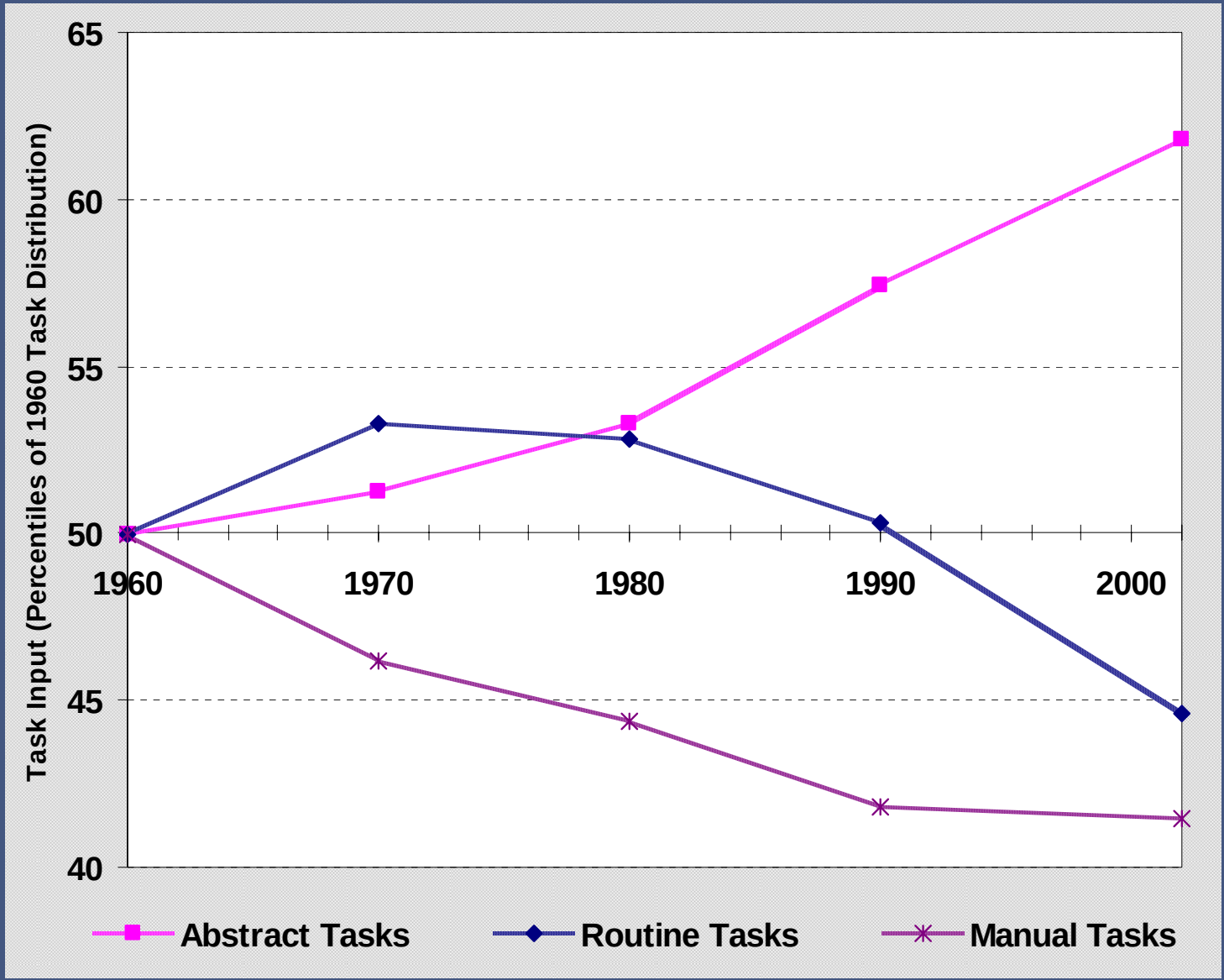
Delegating Non-Routine Manual Tasks to Workers

- **Worker is hands and eyes**
- **Worker's tasks:**
  - Interpret spoken language
  - Walk to bins, retrieve items
  - Pour drinks
  - Handle cash
  - Verify signatures
- **Computer's tasks:**
  - Accounting
  - Inventory and order management
  - Workflow: Coordination of production

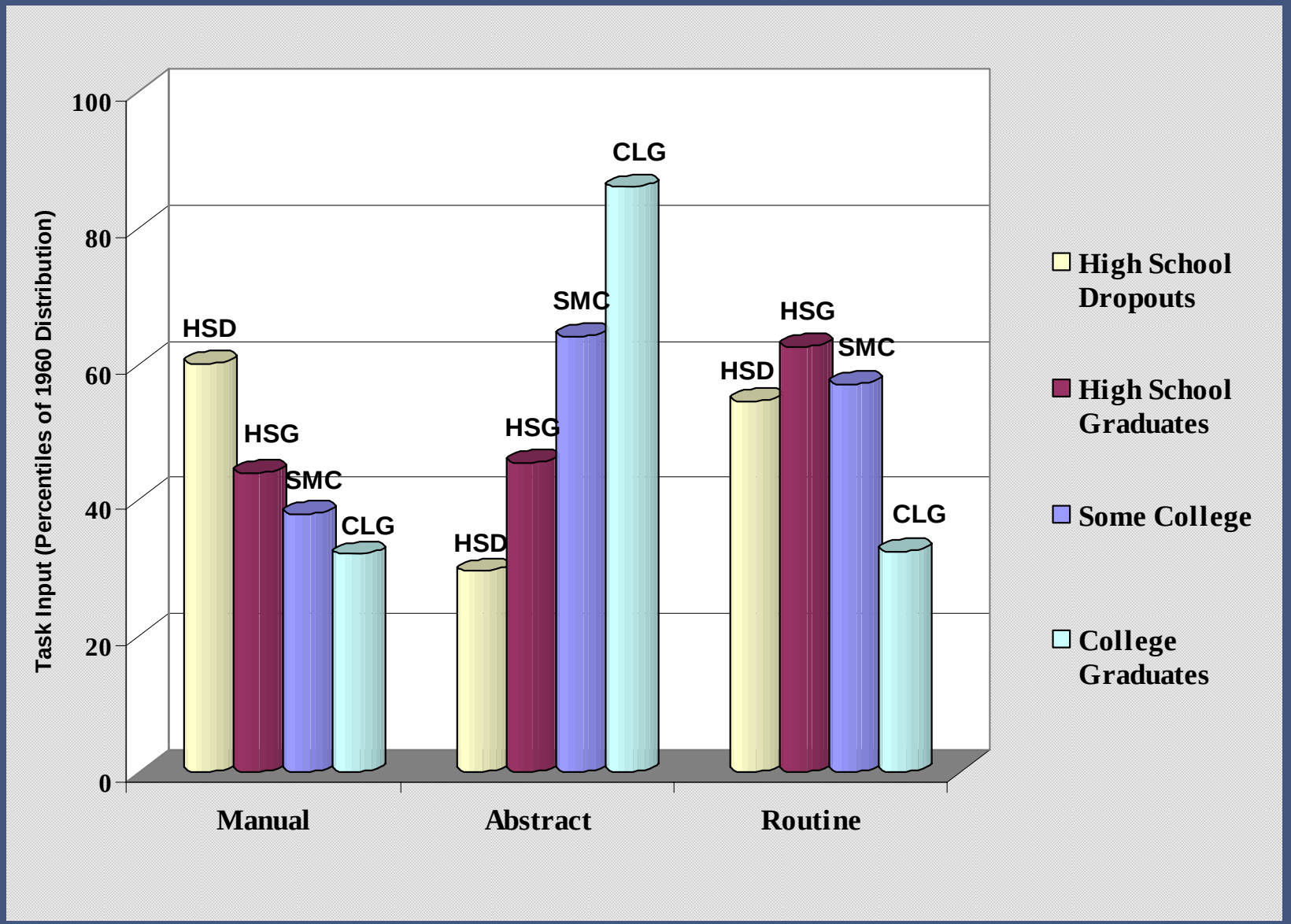
Facilitating Outsourcing: ‘Kiss Your Cubicle Goodbye’



Representative Evidence: Trends in U.S. Job Task Content 1960 – 2002



What does this Have to do with Skill Demands?



‘Polarization’ Framework Suggests

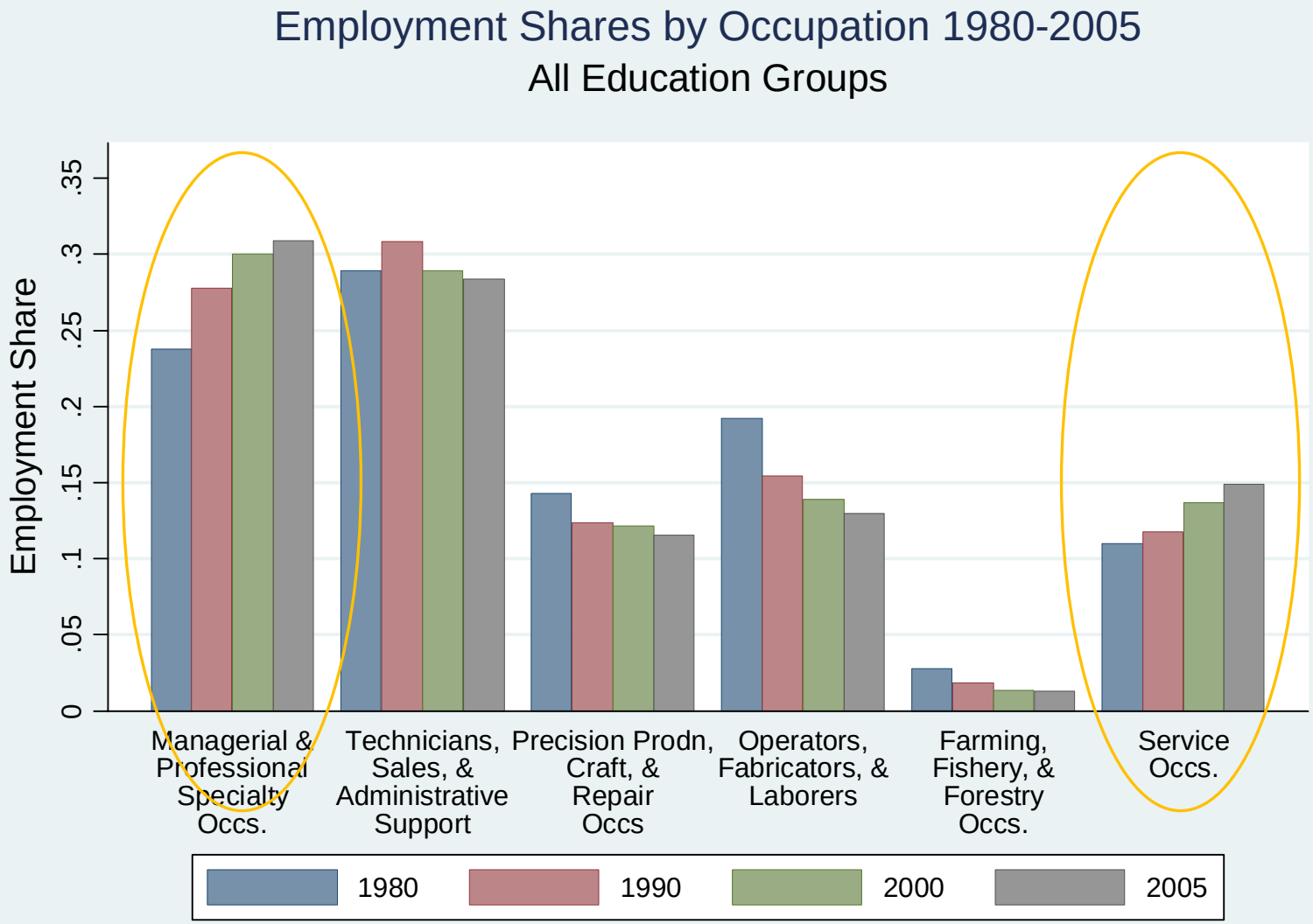
1. **Growth of highly-educated professional and managerial jobs (i.e., those using abstract skills) – ‘Lovely jobs’**

   - *Not a controversial claim…*

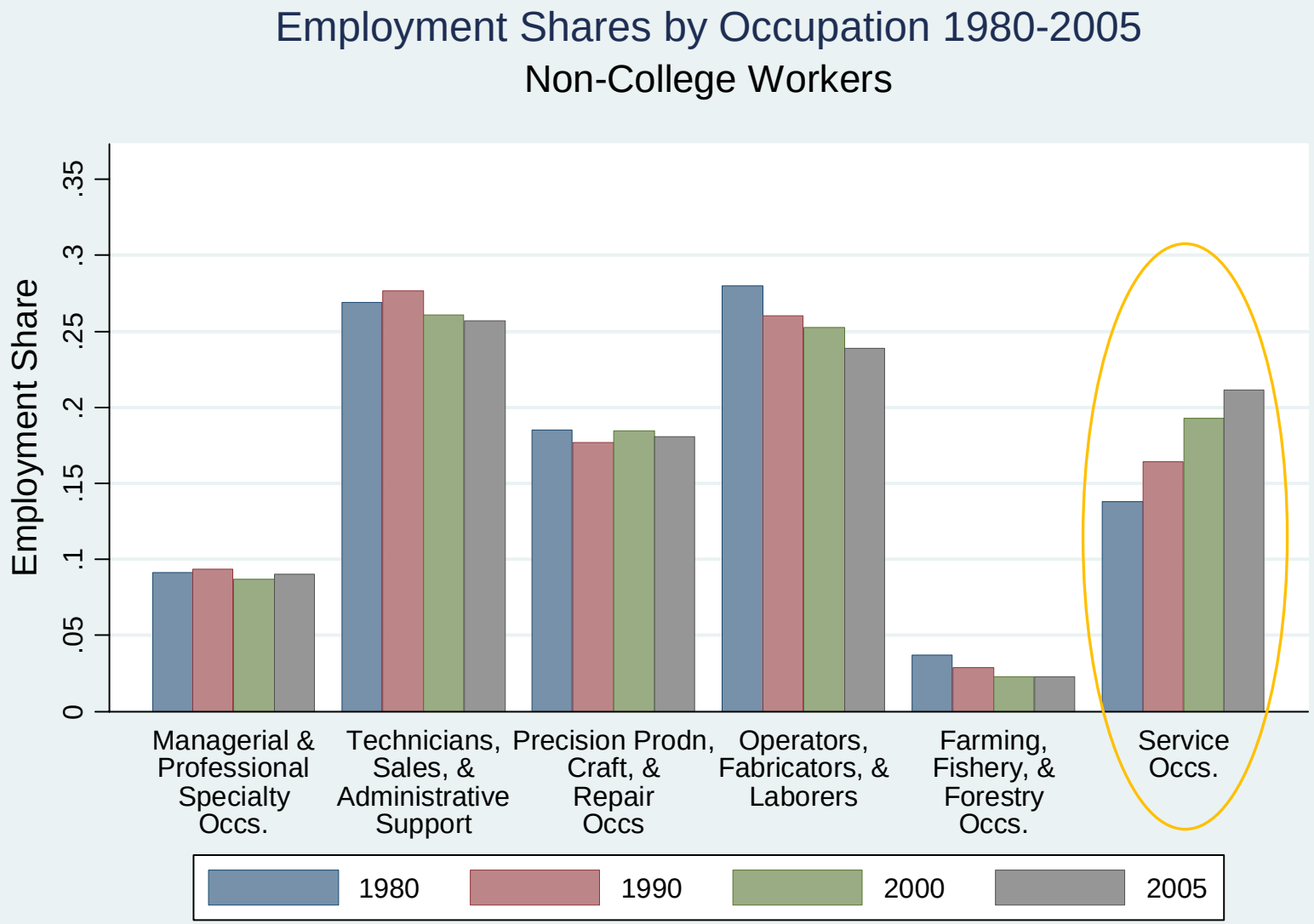
2. **Growth of low-education jobs using ‘non-routine manual’ skills (i.e., those not readily automated) – ‘Lousy jobs’**

   - *Perhaps more novel…*

Growth of High and Low Education Occupations



Occupational Change among *Non-College* Workers (High School or Lower)



Composition of Employment in Service Occupations 2005

** Note: Service occupations ≠ Service sector*

What is Special about Service Occupations?

1. **Difficult to automate:**
   - Demand environmental or interpersonal adaptability.
   - Examples: Waiting tables, caring for the elderly, childcare.

2. **Difficult to outsource/trade:**
   - Require in-person production.
   - Examples: House-cleaning, haircutting, childcare.

3. **Do not require extensive formal schooling – Extensive supply:**
   - Job tasks use 'built-in' skills: locomotion, visual recognition, fine motor coordination, spoken language.
   - Examples: Security guarding, lawn-mowing, cleaning.

The Growth of Low-Education Service Jobs in the US

- **Service occupations: An exception to pattern of stagnant /falling employment and wages in low-education jobs:**

1. Since 1990, growth rate of Service occs as a share of all labor hours has equaled that of Professional and Managerial occs: growing at 2.1 percent per decade.
2. Share of hours worked in Service occs among non-college rose 60 percent between 1980 and 2005: 12.8 to 20.3 percent.
3. Real hourly wages in service occupations increased by more than 20 percent between 1980 and 2005.

US Bureau of Labor Statistics *Occupational Outlook Handbook*

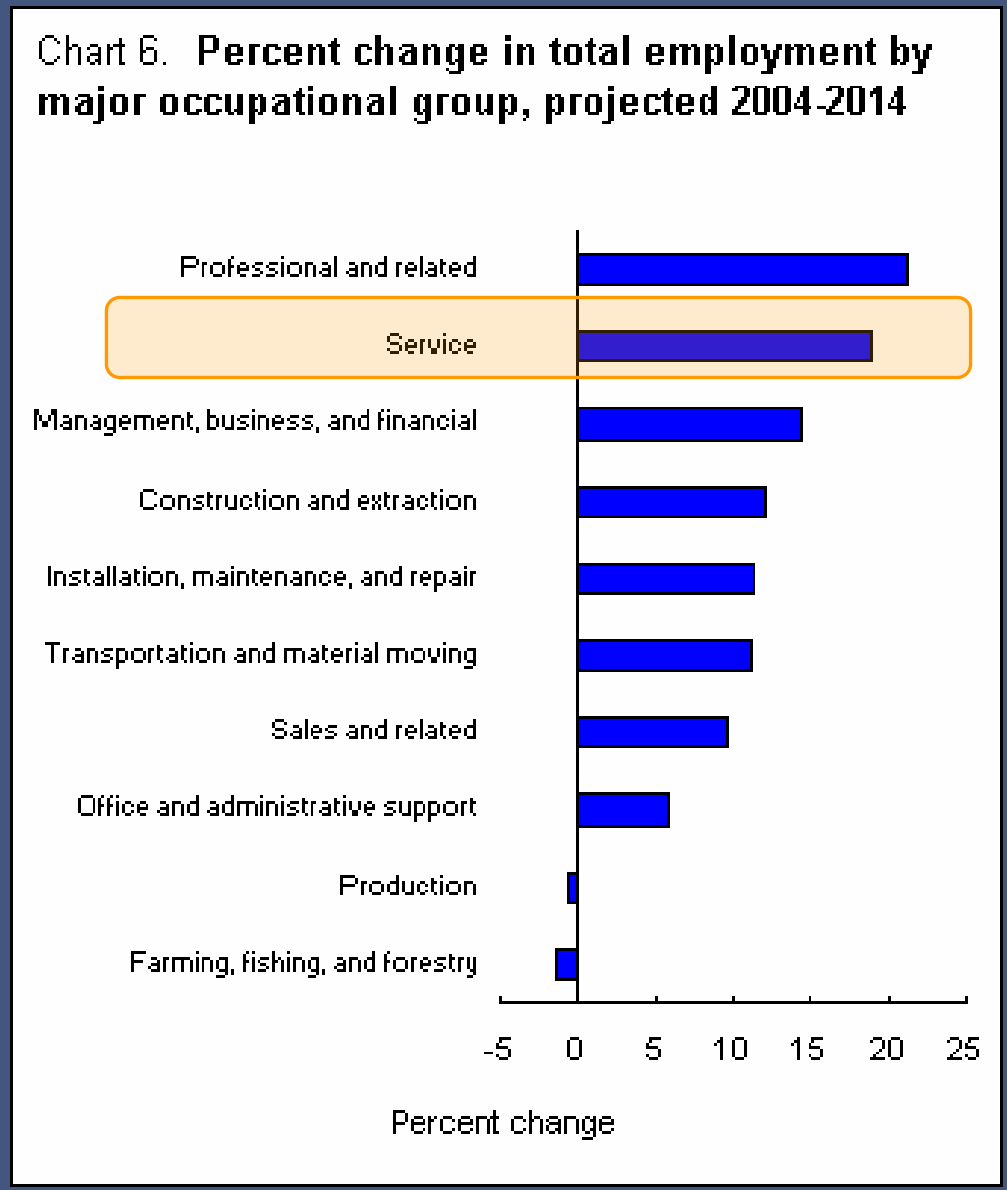


Chart 9. **Job declines in occupations with the largest numerical decreases in employment, projected 2004-2014**

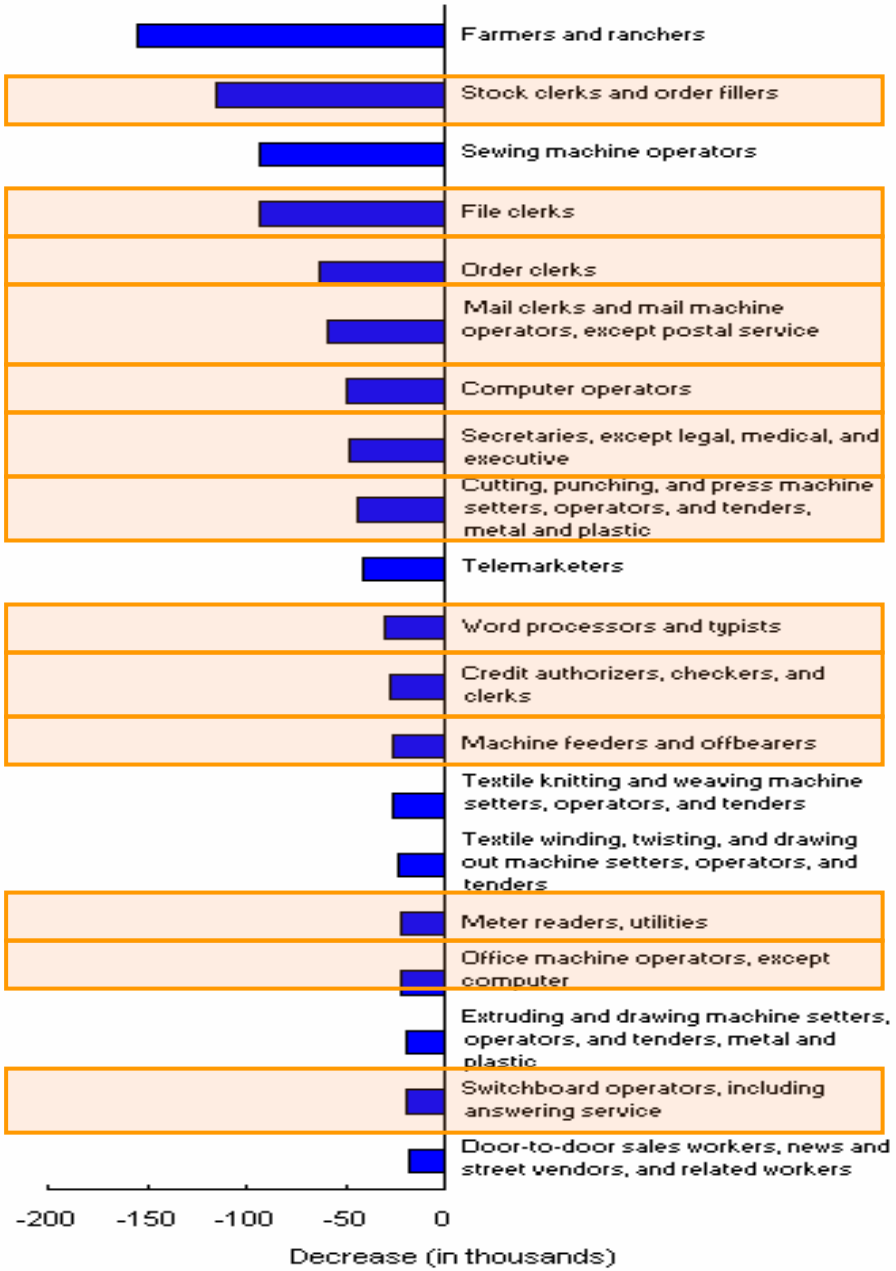
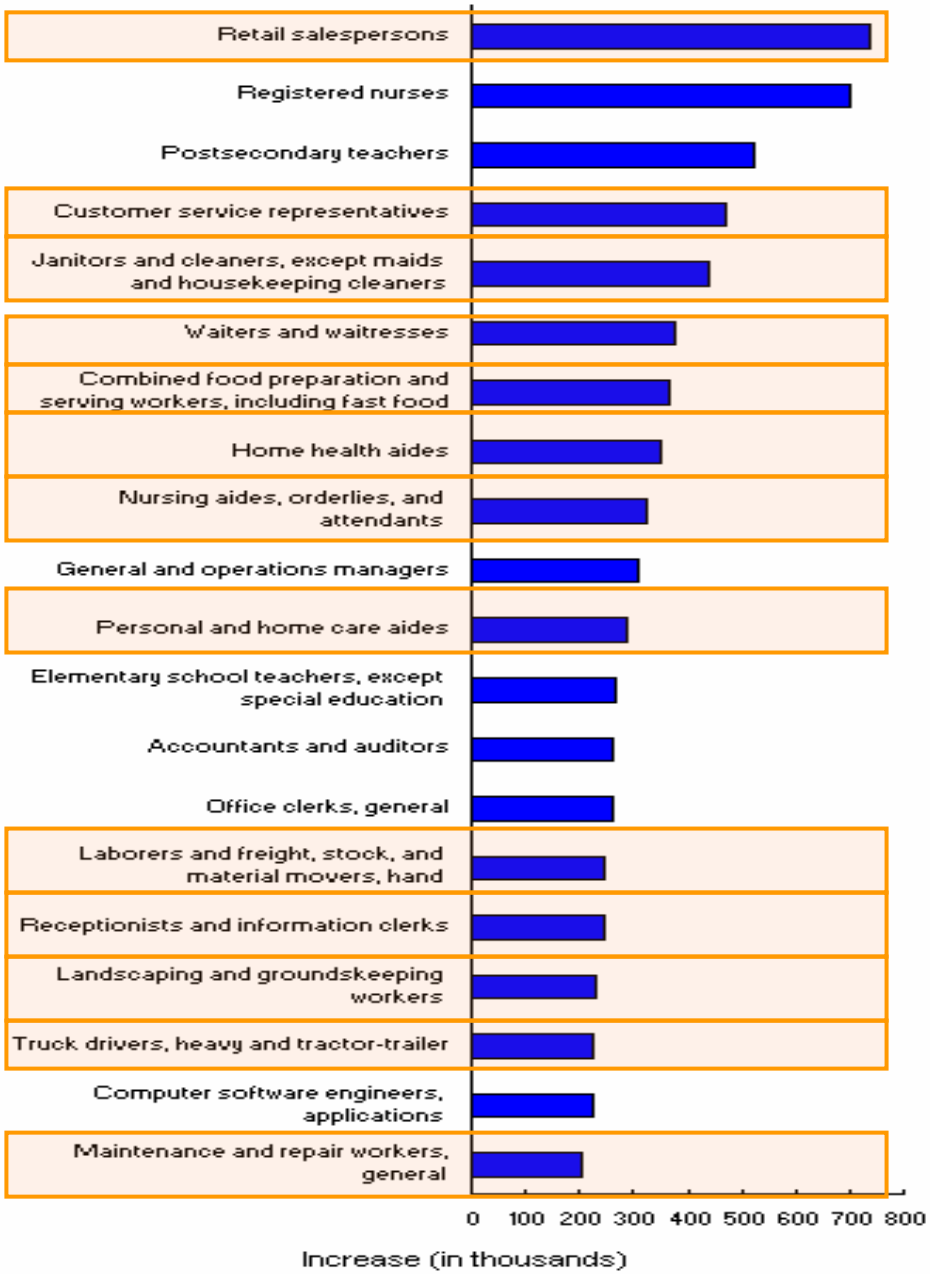


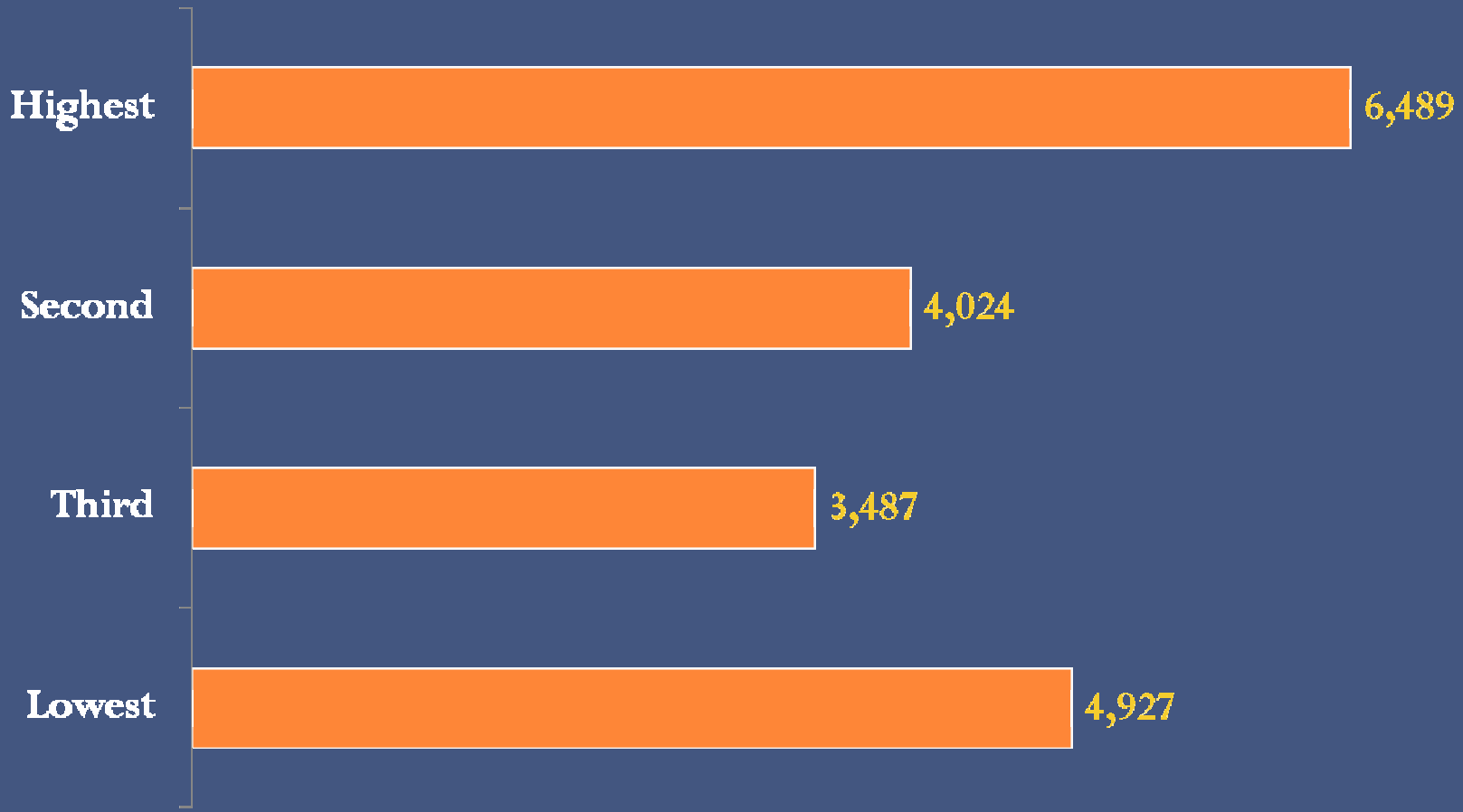
Chart 8. **Occupations with the largest numerical increases in employment, projected 2004-2014**



U.S. Bureau of Labor Statistics

Projections of Job Growth by Wage Level: *Occupational Outlook*, 2004 – 2014

Predicted employment change (in thousands) by 2004 median annual wage quartile, projected 2004-14



Conclusion

- **A historic rise of earnings inequality over 25 years**
- **Rising returns to 'skill' are the central actor in this story**
  - Secular demand shifts favoring highly educated workers
- **But the story is not *that* simple…**
  - Labor demand appears to be polarizing – Rising demand for high and low education jobs.
  - Computerization a key factor – Displacement of 'routine tasks.'
  - Offshoring could be equally disruptive – Great unknown.
- **Expect further polarization of work – 'Lousy and Lovely Jobs'**
- **Policies issues worth discussing:**
  1. Rising demand for highly-educated → Solid case for 'brain gain' policies.
  2. Rising demand for less-educated (*at last*) → Not a problem.
  3. Investing in human capital of young to preserve economic mobility.