Low Skill Work in High Skill Countries: Proximate Causes and Policy Challenges

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Motivation

- **Widely held view:**
  - Low-skill work—that is, *work requiring minimal formal education*—is disappearing in industrialized countries.
  - Why? ‘Skill-biased’ technological change, international trade and offshoring are ‘leaving behind’ only skilled jobs.

- **This view motivates much social and educational policy:**
  - Strive for universal college education.
  - Prep kids for ‘Jobs of future’ in STEM fields.

- **These goals are not wrong-headed, but they are incomplete:**
  - In most industrial economies, job growth is bimodal—‘polarized’
  - Rapid growth in *high and low-skilled* jobs at expense of middle

- **Social policy should recognize and prepare for this challenge:**
  - We will not ‘educate ourselves out’ of low-skill, low wage employment anytime soon.
Change in Employment Shares by Low, Mid and High-Paying Occupation in 16 OECD Countries, 1993 – 2006 (% Pts)

Source: Goos, Manning and Salomons, 2009
## Classification of OECD Occs by Wage Level into High, Mid and Low-Paying Thirds

<table>
<thead>
<tr>
<th>High Paying</th>
<th>Middle Paying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate mngrs</td>
<td>Drivers and mobile plant oprtrs</td>
</tr>
<tr>
<td>Physical, math, engineer prof</td>
<td>Stationary plant and related oprtrs</td>
</tr>
<tr>
<td>Life science and health prof</td>
<td>Metal, machine and related trade work</td>
</tr>
<tr>
<td>Other professionals</td>
<td>Precision, handicraft and production</td>
</tr>
<tr>
<td>Mngrs of small enterprises</td>
<td>Office clerks</td>
</tr>
<tr>
<td>Physical, math, engineer peri-prof</td>
<td>Customer service clerks</td>
</tr>
<tr>
<td>Other associate prof</td>
<td>Extraction and building trades wrks</td>
</tr>
<tr>
<td>Life and health associate prof</td>
<td>Machine oprtrs and assemblers</td>
</tr>
<tr>
<td></td>
<td>Other craft and related trade wrks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low Paying</th>
<th>Production + Office/Clerical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal and protective service wrks</td>
<td></td>
</tr>
<tr>
<td>Mining, construction, manuf, and spec labor</td>
<td></td>
</tr>
<tr>
<td>Models, sales hgts and related</td>
<td></td>
</tr>
<tr>
<td>Sales and service elementary occupations</td>
<td></td>
</tr>
</tbody>
</table>

Source: Goos, Manning and Salomons 2009
Composition of Employment in Service Occupations in 2005
(Slices Proportional to Employment)

- Recreation; Misc. Personal Service
- Personal Appearance
- Child Care
- Cleaning and Laundry
- Protective Service
- Health Aides
- Food Preparation and Service
- Building and Grounds Cleaning and Maintenance

*Note: Service occupations ≠ Service sector*

Source: Autor and Dorn 2009
Employment Shares by Major Occupation Group 1980-2005: United States
U.S. Employment Shares by Major Occupation Group 1980-2005: Non-College Workers (High School or Lower)

Employment Shares by Occupation 1980-2005
Non-College Workers

- Managerial & Professional Specialty Occs.
- Technicians, Sales, & Administrative Support
- Precision Prodn, Craft, & Repair Occs.
- Operators, Fabricators, & Laborers
- Farming, Fishery, & Forestry Occs.
- Service Occs.

Employment Share

- 1980
- 1990
- 2000
- 2005
### Occupational Growth/Contraction during ‘Great Recession’

**Emp. Levels have Changed but Cross-Occ Trends have Not!**

#### Changes in U.S. Employment by Occupation:


<table>
<thead>
<tr>
<th>Occupation</th>
<th>2000 - 05</th>
<th>2005 - 09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manage, Biz, Finance</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Professions</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Health Care</td>
<td>16%</td>
<td>13%</td>
</tr>
<tr>
<td>Sales</td>
<td>4%</td>
<td>-6%</td>
</tr>
<tr>
<td>Office/Admin</td>
<td>-5%</td>
<td>-8%</td>
</tr>
<tr>
<td>Production</td>
<td>-21%</td>
<td>-24%</td>
</tr>
<tr>
<td>Construction/Repair</td>
<td>11%</td>
<td>-17%</td>
</tr>
<tr>
<td>Transportation</td>
<td>0%</td>
<td>-11%</td>
</tr>
<tr>
<td>Security/Cleaning</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Personal Svc/Rest.</td>
<td>15%</td>
<td>-1%</td>
</tr>
</tbody>
</table>

**Note:** Correlation between Employment share changes 2000/2005 vs. 2005/2009 is 0.67.

Source: U.S. Bureau of Labor Statistics
Agenda
Low Skill Work in High Skill Countries

1. ‘Polarization’ of employment
   • Some motivating facts from U.S. and OECD
   • A closer look at wage inequality trends

2. Why is low-skilled work growing? A simple hypothesis
   • Automation and human comparative advantage

3. Evidence from U.S. regions
   • Measuring susceptibility to ‘polarization’
   • Measuring employment polarization across ‘Commuting Zones’

4. Evidence across age cohorts
   • Occupational change and age structure – What jobs do older workers occupy as occupational structure hollows out?

5. Summary and policy conundrums
Rapid Growth of Low-Skill Employment in U.S. Since late 1980s

Smoothed Changes in Employment by Occupational Skill Percentile 1980-2000

100 x Change in Employment Share

0 0.05 0.1 0.15

Skill Percentile (Ranked by Occupational Mean Wage)

1980-1990

1990-2000
Rapid Growth of Low-Skill Employment in U.S. Since late 1980s
Contemporaneous ‘Polarization’ of U.S. Earnings Growth


Wage Percentile

Log real earnings change

0 0.05 0.1 0.15

-0.05 0 0.05 0.1 0.15

pctile

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

Notable Correspondence: Suggests an Important Role for Demand-Side Factors


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Hypothesis: Recent Technological Change has had Non-Neutral Impacts on Skill Demands

1. **Start with narrow question: Job tasks**
   - How does technological change—information technology specifically—affect the ‘task’ content of jobs?

2. **Broaden: Task demand → Skill demands**
   - Consider how demand for ‘tasks’ affects demand for skills (‘human capital’).

3. **But first, a brief review...**
One Minute of History: Stages of Automation

1. **Substitution of (1) animal power and then (2) mechanical energy for human musculature**
   - E.g., horse-drawn plow, steam/water power
   - Electricity, fossil-fuels
   - **Skill-biased**: An unskilled-labor saving technical change

2. **Substitution of machinery for labor in artisanal tasks**
   - Mass production, the ‘factory system,’ Fordism
   - Workers functioning as machines, e.g., Time and Motion
   - **Unskilled-biased** Skilled labor saving, automation of artisanal tasks

3. **Batch and continuous-process production (e.g., chemicals, molten metals, liquors)**
   - Demanded literacy, numeracy, engineering know how.
   - **Skill-biased**: Required formal technical skills.

4. **Computerization...**
   - How does computerization affect skill demands?
What does Information Technology actually do?
A Task Framework (Autor, Levy and Murnane 2003)

- **Conceptualize job from “machine’s-eye” view – A set of tasks**
  - Moving an object.
  - Performing a calculation.
  - Communicating a piece of information.
  - Resolving a discrepancy.

- **Question: Which tasks can be performed by a computer?**
  - Consider the tasks that computerization *complements* and the tasks for which it *substitutes*.

- **Two defining traits of Computers:**
  2. Actions deterministically specified by explicit procedures (‘programs’).
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
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.)
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
  - Examples: Spreadsheets replace bookkeepers; Electronic tags replaces toll collectors on highways

- 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.
What do Computers not do? ‘Non-Routine’ Tasks

• But ‘knowing the rules’ not a trivial requirement. Procedures for accomplishing many commonplace tasks not explicitly understood.
  • “We can know more than we can tell...” Michael Polanyi, 1966

• Two broad categories of tasks for which we do not ‘know the rules’:

1. ‘Abstract’ tasks – Demanding mental flexibility, problem-solving, creativity
   • Solving novel/unstructured problems.
   • Developing and testing hypotheses.
   • Managing others.
   • E.g, Educators, doctors, managers, scientists, lawyers, engineers, artists.

2. ‘Manual’ tasks – Requiring physical adaptability or non-scripted interpersonal interactions
   • Driving a vehicle through city traffic.
   • Serving a meal at a restaurant.
   • Conversing in spoken language.
   • Vacuuming a room.
   • E.g, Janitors, security guards, construction workers, home health aides.
# The Impact of Computerization on Three Broad Task Categories

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Example Occupations</th>
<th>Potential Impact of Computerization</th>
</tr>
</thead>
</table>
| **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 |
Relevance for Skill Demands, Employment Polarization?

Source: Autor, Levy and Murnane 2003
How Does Task Demand Affect Demand for Education?
Change in Employment Shares by Low, Mid and High-Paying Occupation in 16 OECD Countries, 1993 – 1996 (% Pts)

Source: Goos, Manning and Salomons, 2009

<table>
<thead>
<tr>
<th>Largest Projected Numerical Employment Losses</th>
<th>Largest Projected Numerical Employment Gains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock clerks and order fillers</td>
<td>Registered nurses</td>
</tr>
<tr>
<td>Cashiers, except gaming</td>
<td>Retail salespersons</td>
</tr>
<tr>
<td>Packers and packagers, hand</td>
<td>Customer service representatives</td>
</tr>
<tr>
<td>File clerks</td>
<td>Combined food prep + serving workers</td>
</tr>
<tr>
<td>Farmers and ranchers</td>
<td>Office clerks, general</td>
</tr>
<tr>
<td>Order clerks</td>
<td>Personal and home care aides</td>
</tr>
<tr>
<td>Sewing machine operators</td>
<td>Home health aides</td>
</tr>
<tr>
<td>Electrical &amp; electronic equip assemblers</td>
<td>Postsecondary teachers</td>
</tr>
<tr>
<td>Cutting, punching and press machine operators and tenders</td>
<td>Janitors and cleaners</td>
</tr>
<tr>
<td>Telemarketers</td>
<td>Nursing aides, orderlies and attendants</td>
</tr>
<tr>
<td>Inspectors, testers, sorters, samplers and weighers</td>
<td>Waiters and waitresses</td>
</tr>
</tbody>
</table>
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. **Yet, minimal education required**
   - Use ‘onboard’ manual skills
   - Spoken language, physical adaptability
The Central Role of Service Occupations in Employment Polarization, 1980 – 2005

Smoothed Changes in Employment by Occupational Skill Percentile 1980-2005

100 x Change in Employment Share

Skill Percentile (Ranked by Occupational Mean Wage)

1980-1990  1990-2005
The Central Role of Service Occupations in Employment Polarization, 1980 – 2005

Smoothed Changes in Employment by Occupational Skill Percentile 1980-2005
Service Employment Share at 1980 Level

100 x Change in Employment Share

Skill Percentile (Ranked by Occupational Mean Wage)

-1
-0.5
0
0.5
1
1.5

0 20 40 60 80 100

1980-1990
1990-2005
Adjusting for Growth of Service Employment, Wage Polarization also Less Pronounced in 1990s
Adjusting for Growth of Service Employment, Wage Polarization also Less Pronounced in 1990s

Changes in Wages and Employment over 1990 to 2000: Observed and ‘Service-Employment-Constant’ Series

A. $\Delta$ Employment by Skill Level

B. $\Delta$ Real Hourly Wage by Percentile
1. ‘Polarization’ of employment
   - Some motivating facts from U.S. and OECD
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2. Why is low-skilled work growing? A simple hypothesis
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Evidence from U.S. Regions: Autor and Dorn (2009), “Inequality and Specialization”

• **Main hypothesis**
  1. Polarization is driven by falling demand for routine-intensive occs
  2. Leads to growth of low-skill service occupation employment as ‘routine’ workers move down the occ distribution

• **Implication**
  • Local labor markets that were initially specialized (i.e., in 1980) in routine-intensive occupations should see differential growth of service occs.
  • *Why?* These markets will differentially ‘hollow out’ because they are holding stock in a declining enterprise.

• **Two things needed for empirical implementation**
  1. Definition of local labor markets: ‘Commuting Zones’
  2. Measure of ‘Routine task-intensity’ of occupations
Definition of Local Labor Markets: ‘Commuting Zones’

- Based on commuting patterns among counties in 1990
  - Clusters of counties that exhibit strong commuting ties within clusters but weak commuting across clusters.
  - We use 722 CZs that cover the entire U.S. mainland (not just MSAs!).
  - CZs can be constructed from Public Use Micro Areas (PUMAs) for all years of our sample (1980, 1990, 2000, 2005).
Measuring the ‘Routine Task Intensity’ of Occupations and Commuting Zones

1. Rank occupations \( k \) by ratio of Routine to Manual task input in 1980

\[
R_k = \ln(\frac{\hat{R}_{k,1980}}{\hat{M}_{k,1980}})
\]

2. Label top third (weighted by employment) of this ranked list as ‘Routine Occs’

\[
ROCC_k = \begin{cases} 
1 & \text{if } \sum_{i=1}^{k} L_{i,1980} \leq \frac{1}{3} \sum_{i=1}^{K} L_{i,1980} \\
0 & \text{otherwise}
\end{cases}
\]

3. For each Commuting Zone \( j \), calculate the share of employment in ‘Routine Occs’ in each period \( t \):

\[
RTI_{j,t} = \frac{\sum_{k=1}^{K} (L_{j,k,t} \times ROCC_k)}{\sum_{k=1}^{K} L_{j,k,t}} \quad \text{with } 1 \geq RTI_{j,t} \geq 0
\]
### Examples of Routine-Intensive Occupations

#### Occupations with Highest and Lowest Routine Task Intensity Scores

<table>
<thead>
<tr>
<th>A. Highest Routine Task Intensity</th>
<th>B. Lowest Routine Task Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Secretaries and Stenographers</td>
<td>1 Parking Lot Attendants</td>
</tr>
<tr>
<td>2 Bank Tellers</td>
<td>2 Fire Fighting, Prevention and Inspection</td>
</tr>
<tr>
<td>3 Pharmacists</td>
<td>3 Bus Drivers</td>
</tr>
<tr>
<td>4 Payroll and Timekeeping Clerks</td>
<td>4 Taxi Cab Drivers and Chauffeurs</td>
</tr>
<tr>
<td>5 Motion Picture Projectionists</td>
<td>5 Public Transp. Attend. and Inspectors</td>
</tr>
<tr>
<td>6 Boilermakers</td>
<td>6 Police and Detectives, Public Service</td>
</tr>
<tr>
<td>7 Butchers and Meat Cutters</td>
<td>7 Truck, Delivery, and Tractor Drivers</td>
</tr>
<tr>
<td>8 Accountants and Auditors</td>
<td>8 Garbage and Recyclable Mat. Collectors</td>
</tr>
<tr>
<td>9 Actuaries</td>
<td>9 Crossing Guards</td>
</tr>
<tr>
<td>10 Proofreaders</td>
<td>10 Railroad Coupler and Switch Operators</td>
</tr>
</tbody>
</table>

Notes: Routine occupations are defined as occupations with large routine task / manual task ratios. The total employment share of routine occupations is set to 1/3 in 1980. Adjusted shares of total employment account for variation in detail of occupational classification across major occupation groups by dividing an occupation’s share in total employment by the average employment share of occupations in the same major occupation group.
Change in Computer Use by C’Zone, 1980 - 2002

Change in 'Adjusted' PCs per Employee (Doms/Lewis 2)
by Commuting Zone 1980-2002

95% CI  Fitted values  d_rpc

Change in 'Adjusted' PCs per Employee

Share of Empl in Routine-Intensive Occs in 1980
Change in Routine Emp. Share by Commuting Zone, 1980 - 2005

Change in Routine Emp Share: Non-College

by Commuting Zone 1980-2005
Change in Routine Emp. Share by Commuting Zone, 1980 - 2005

Change in Routine Emp Share: College
by Commuting Zone 1980-2005
Displacement of Routine Work and Computer Adoption

Routine Emp Share Non-College

Change in Routine Emp Share: Non-College by Commuting Zone 1980-2005

‘Adjusted’ PCs per Employee (Doms and Lewis, 2006)

Change in ‘Adjusted’ PCs per Employee (Doms/Lewis) by Commuting Zone 1980-2002

\[ \Delta SVC_{j}^{1980-2005} = -0.039 + 0.323 \times RSH_{j,1980} + e_{j}, t = 18.1, n = 722, R^2 = 0.31 \]
Routine Employment Shares 1980 and Growth in Service Occs in Major U.S. Cities (Pop > 1M) between 1980 and 2005

\[ \Delta SVC_{j}^{1980-2005} = -0.089 + 0.498 \times RSH_{j,1980} + e_j, \quad t = 3.2, \quad n = 40, \quad R^2 = 0.21 \]
Instrumenting Geographic Variation in Routine Occupation Share using Historical Industry Structure (from 1950)

- **Concern:** ‘Routine Occupation Share is endogenous’
  - Would like to exploit pre-determined variation in this measure.
- **Approach: Exploit historical industry structure variation**
  - Cities are historically specialized in different industries
  - Variation in industry mix affects relative use of routine task inputs
  - Use 1950 industry structure to construct instrument that predicts routine occupation shares during the following half century
- **Specifically:**
  - For each Commuting Zone $j$, calculate predicted share of ‘Routine Occs’ in 1950 using local industry mix and share of ‘Routine Occs’ in each industry $m$ in out-of-state Commuting Zones $-j$:

\[
PRTI_{1950}^{j} = \sum_{m=1}^{M} (L_{jm}^{1950} \times SHRT_{j-m}^{1950})
\]
Predicting Growth of Service Work in Commuting Zones

- Commuting zone level regression (722 C-Z’s x 5 decadal Δ’s):
  \[ \Delta S_{jτ}^{nc} = \alpha + \beta_o RSH_{j,t} \times I[t \geq 1980] + \beta_1 RSH_{j,t} + \Delta X'_{jτ} \beta_2 + \epsilon_{jτ} \]

- Dependent variable:
  - Share of non-college employment in service occs

- Controls—Contemporaneous measures of:
  - Manufacturing employment share
  - Unemployment rate
  - College/Non-college pop ratio
  - Immigrant share/Non-college pop
  - Female empl/pop
  - Age 65+/pop

- Start-of-period RSH instrumented with predicted 1950 RSH
Bivariate Regressions: Routine Employment Share and Growth of Service Employment by Decade

Dependent Variable: 10 × Annual Change in Share of Non-College Employment in Service Occupations

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Share of Routine Occups.(_{-1})</td>
<td>-0.122 **</td>
<td>0.032</td>
<td>0.082 **</td>
<td>0.084 *</td>
<td>0.321 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.034)</td>
<td>(0.024)</td>
<td>(0.037)</td>
<td>(0.087)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.022 **</td>
<td>-0.032 **</td>
<td>-0.014 *</td>
<td>-0.003</td>
<td>-0.042</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.009)</td>
<td>(0.007)</td>
<td>(0.011)</td>
<td>(0.027)</td>
<td></td>
</tr>
</tbody>
</table>

II. IV Estimates

<table>
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<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Routine Occups.(_{-1})</td>
<td>-0.136 **</td>
<td>0.063</td>
<td>~ 0.075 **</td>
<td>0.153 **</td>
<td>0.539 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.032)</td>
<td>(0.026)</td>
<td>(0.043)</td>
<td>(0.111)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.025 **</td>
<td>-0.040 **</td>
<td>-0.012</td>
<td>-0.023 ~</td>
<td>-0.109 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.009)</td>
<td>(0.008)</td>
<td>(0.013)</td>
<td>(0.034)</td>
<td></td>
</tr>
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</table>

III. IV 1st Stage

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted Share of Routine Occups. 1950</td>
<td>1.078 **</td>
<td>0.704 **</td>
<td>0.627 **</td>
<td>0.456 **</td>
<td>0.366 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.074)</td>
<td>(0.060)</td>
<td>(0.061)</td>
<td>(0.052)</td>
<td>(0.043)</td>
<td></td>
</tr>
</tbody>
</table>

State dummies: Yes, Yes, Yes, Yes, Yes

N= 722 commuting zones. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period commuting zone share of national population. ~ p £ 0.10, * p £ 0.05, ** p £ 0.01.
## Routine Employment Share and Growth of Service Emp:
Dep Var: 10 x Annual Δ in Share of Non-College Emp in Svc Occs

Dep Var: 10 × Annual Chg in Share of Non-College Emp in Svc Occs

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Routine Occs. ×</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980-2005</td>
<td>0.141 **</td>
<td>0.160 **</td>
<td>0.203 **</td>
<td>0.098 **</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.021)</td>
<td>(0.025)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Share of Routine Occs.</td>
<td>-0.086 **</td>
<td>-0.061 **</td>
<td>-0.023</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.015)</td>
<td>(0.020)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>College/Non-college pop.</td>
<td>0.008</td>
<td></td>
<td></td>
<td>0.011 **</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td></td>
<td></td>
<td>(0.004)</td>
</tr>
<tr>
<td>Immigr/Non-college pop.</td>
<td>0.028 ~</td>
<td></td>
<td></td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td></td>
<td></td>
<td>(0.016)</td>
</tr>
<tr>
<td>Manufact/empl.</td>
<td>-0.027 **</td>
<td>-0.011</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment rate.</td>
<td>-0.096 *</td>
<td>-0.267 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.069)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female empl/pop.</td>
<td></td>
<td>-0.090 **</td>
<td>-0.142 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.021)</td>
<td>(0.027)</td>
<td></td>
</tr>
<tr>
<td>Age 65+/pop.</td>
<td>-0.046</td>
<td>-0.037</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.024)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.403</td>
<td>0.404</td>
<td>0.415</td>
<td>0.440</td>
</tr>
</tbody>
</table>

N=3610. Robust SE's in parentheses are clustered on state. Models include 4 time period dummies and a constant. ~ p £ 0.10, * p £ 0.05, ** p £ 0.01.
Routine Employment Share and Growth of Service Emp: Subgroups of Service Occupations

Dependent Variable: 10 × Annual Change in Share of Non-College Employment in Specific Service Occupation

<table>
<thead>
<tr>
<th></th>
<th>Food Service</th>
<th>Building Clean/Garden</th>
<th>Health Support</th>
<th>House Clean/Laundry</th>
<th>Child Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Routine Occs..1 × 1980-05</td>
<td>0.064 **</td>
<td>0.044 **</td>
<td>0.013</td>
<td>0.018</td>
<td>0.019 **</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Share of Routine Occs..1</td>
<td>-0.012</td>
<td>~ 0.001</td>
<td>-0.007</td>
<td>~ -0.013 *</td>
<td>-0.006 *</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.006)</td>
<td>(0.003)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Personal Appearance</th>
<th>Security Guards</th>
<th>Recreation</th>
<th>Misc Personal Svcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Routine Occs..1 × 1980-05</td>
<td>0.020 **</td>
<td>0.010 *</td>
<td>0.015 **</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.004)</td>
<td>(0.004)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Share of Routine Occs..1</td>
<td>-0.007 **</td>
<td>0.005 *</td>
<td>-0.008 **</td>
<td>-0.021 **</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.008)</td>
</tr>
</tbody>
</table>

N=3610 (5 time periods x 722 commuting zones). Robust SE's in parentheses are clustered on state. ~ p = 0.10, * p = 0.05, ** p = 0.01.
# Routine Employment Share and Growth of Service Emp: Subgroups of Population

## Dependent Variable: 10 × Annual Change in Share of Non-College Employment in Service Occupations

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>US Borns</th>
<th>Foreign Borns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Routine</td>
<td>0.168</td>
<td>0.141</td>
<td>0.058</td>
<td>0.315</td>
</tr>
<tr>
<td>Occs. (-1)</td>
<td>0.023</td>
<td>0.080</td>
<td>0.028</td>
<td>0.091</td>
</tr>
<tr>
<td>Share of Routine</td>
<td>-0.014</td>
<td>0.036</td>
<td>-0.057</td>
<td>-0.081</td>
</tr>
<tr>
<td>Occs. (-1) × 1980-05</td>
<td>0.015</td>
<td>0.036</td>
<td>0.018</td>
<td>0.069</td>
</tr>
<tr>
<td>Constant</td>
<td>0.005</td>
<td>-0.037</td>
<td>0.018</td>
<td>0.020</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
<td>0.010</td>
<td>0.004</td>
<td>0.015</td>
</tr>
</tbody>
</table>

State dummies: Yes, Yes, Yes, Yes

\[ R^2 = 0.236, 0.512, 0.283, 0.052 \]

N=3610 (5 time periods x 722 commuting zones). Robust SE's in parentheses are clustered on state. \( \sim p = 0.10, * p = 0.05, ** p = 0.01 \).
Smoothed Changes in Employment by Occupational Skill Percentile

All Commuting Zones

100 x Change in Employment Share

Skill Percentile (Ranked by Occupational Mean Wage)

1980-1990

1990-2000

All Commuting Zones
Smoothed Changes in Employment by Occupational Skill Percentile

All Commuting Zones

Holding Service Employment Share at 1980 Level

100 x Change in Employment Share

Skill Percentile (Ranked by Occupational Mean Wage)

1980-1990

1990-2000

All Commuting Zones
Smoothed Changes in Employment by Occupational Skill Percentile Ranked by Occupational Mean Wage

Commuting Zones with above Median Routine Share in 1980

100 x Change in Employment Share

Commuting Zones Above Median Routine Emp Share in 1980

Skill Percentile (Ranked by Occupational Mean Wage)

1980-1990

1990-2000
Smoothed Changes in Employment by Occupational Skill Profile

Commuting Zones with Below Median Routine Emp Share in 1980

100 x Change in Employment Share

Skill Percentile ( Ranked by Occupational Mean Wage )

1980-1990

1990-2000

Commuting Zones Below Median Routine Emp Share in 1980
Smoothed Changes in Employment by Occupational Skill Percentile

Commuting Zones with Below Median Routine Share in 1980 Holding Service Employment Share at 1980 Level

Commuting Zones Below Median Routine Emp Share in 1980

100 x Change in Employment Share

Skill Percentile (Ranked by Occupational Mean Wage)

Some Evidence on Alternative Hypotheses

• Is the explanation income/substitution effects rather than occupational displacement (e.g., Mazzolari and Ragusa 2008)?

  a. Income effects: Rising consumption of luxuries by wealthy
  b. Substitution effects: Outsourcing of household production by skilled workers to allow increased market hours

• Testing these alternatives

  a. Income effects
     • Control for change in 90th percentile of the weekly wage distribution as measure of inequality
  b. Substitution effects
     • Control for change in college graduates annual hours of work as measure of LFP
Addressing Alternative Explanations:
Income Effects (Top Wages), Substitution Effects (College Hrs)

<table>
<thead>
<tr>
<th></th>
<th>A. Dep Var: $\Delta \ln(P90)$</th>
<th>B. Dep Var: $\Delta$ Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Share of Routine Occs, t-1</td>
<td>0.794 ** (0.093)</td>
<td>0.053 * (0.023)</td>
</tr>
<tr>
<td></td>
<td>0.439 ** (0.159)</td>
<td>0.201 ** (0.063)</td>
</tr>
<tr>
<td>Control variables</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

N=2166 (3 time periods x 722 commuting zones). Robust SE's in parentheses are clustered on state. Models are weighted by commuting zones' share in total labor supply in a given year. All models include an intercept, state dummies, and time dummies. \( \sim p \leq 0.10 \), \( * p \leq 0.05 \), \( ** p \leq 0.01 \).
### Addressing Alternative Explanations:
Income Effects (Top Wages), Substitution Effects (College Hrs)

<table>
<thead>
<tr>
<th>Dep Var: Δ Non-Coll Emp in Service</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of Routine Occs.₁</td>
<td>0.137</td>
<td>**</td>
<td>0.134</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.025)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ ln(P90) Weekly Wage</td>
<td>-0.010</td>
<td></td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td></td>
<td>(0.015)</td>
<td></td>
</tr>
<tr>
<td>Δ Avg Annual Hours per Coll Grad / 2080</td>
<td>-0.099</td>
<td>**</td>
<td>-0.091</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td></td>
<td>(0.034)</td>
<td></td>
</tr>
</tbody>
</table>

N=2166 (3 time periods x 722 commuting zones). Robust SE's in parentheses are clustered on state. Models are weighted by commuting zones' share in total labor supply in a given year. All models include an intercept, state dummies, and time dummies. ~ p ≤ 0.10, * p ≤ 0.05, ** p ≤ 0.01.
Some Evidence on Alternative Hypotheses

• Are we capturing the effects of offshoring?

• A recent theoretical and empirical literature considers the effect of trade in job tasks on the labor market
  • e.g., Grossman and Rossi-Hansberg (2008); Blinder (2009); Blinder and Krueger (2009); Firpo, Fortin and Lemieux (2009)

• Non-offshorable tasks require physical proximity to people (e.g., customers) or places (e.g., plants, buildings)

• We measure non-offshorability by the average of two task measures that Firpo, Fortin and Lemieux derive from O*Net data:
  • “Onsite”: Inspecting/repairing equipment, operating vehicles, etc.
  • “Face”: Face-to-face discussions, working with the public, etc.
### Most and Least Offshorable Occupations

#### Occupations with Highest and Lowest Physical Proximity Requirements

<table>
<thead>
<tr>
<th>A. Least Offshorable (Highest Proximity Requirements)</th>
<th>B. Most Offshorable (Lowest Proximity Requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Respiratory Therapists</td>
<td>1 Clothing Pressing Machine Operators</td>
</tr>
<tr>
<td>2 Dentists</td>
<td>2 Weighers, Measurers, and Checkers</td>
</tr>
<tr>
<td>3 Fire Fighting/Prevention/Inspection Occs</td>
<td>3 Mathematicians and Statisticians</td>
</tr>
<tr>
<td>4 Elevator Installers and Repairers</td>
<td>4 Operations and Systems Researchers/Analysts</td>
</tr>
<tr>
<td>5 Podiatrists</td>
<td>5 Billing Clerks, Financial Records Processing</td>
</tr>
<tr>
<td>6 Electric Power Installers and Repairers</td>
<td>6 Computer Software Developers</td>
</tr>
<tr>
<td>7 Registered Nurses</td>
<td>7 Technical Writers</td>
</tr>
<tr>
<td>8 Paving, Surfacing, Tamping Equipment Ops</td>
<td>8 Correspondence and Order Clerks</td>
</tr>
<tr>
<td>9 Supervisors of Mechanics and Repairers</td>
<td>9 Insurance Underwriters</td>
</tr>
<tr>
<td>10 Police and Detectives, Public Service</td>
<td>10 Payroll and Timekeeping Clerks</td>
</tr>
</tbody>
</table>
## Addressing Alternative Explanations: Offshoring

<table>
<thead>
<tr>
<th></th>
<th>Dep Var: Δ Non-Coll Emp in Svc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Share of Routine Occs(_{-1})</td>
<td>0.153 **</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
</tr>
<tr>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>Index of Non-Offshorability(_{-1})</td>
<td>-0.007 (0.005)</td>
</tr>
<tr>
<td></td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
</tr>
</tbody>
</table>

N=2166 (3 time periods x 722 commuting zones). Robust SE's in parentheses are clustered on state. The non-offshorability index is standardized to a mean of 0 and SD of 1 in 1980. ~ p = 0.10, * p = 0.05, ** p = 0.01.
Agenda
Low Skill Work in High Skill Countries

1. ‘Polarization’ of employment
   • Some motivating facts from U.S. and OECD
   • A closer look at wage inequality trends

2. Why is low-skilled work growing? A simple hypothesis
   • Automation and human comparative advantage

3. Evidence from U.S. regions
   • Measuring susceptibility to ‘polarization’
   • Measuring employment polarization across ‘Commuting Zones’

4. Evidence across age cohorts
   • Occupational change and age structure – What jobs do older workers occupy as occupational structure hollows out?

5. Summary and policy conundrums
‘Middle-Skill’ Occupations are Declining as a share of U.S. Employment
Change in Mean Occupational Age
by Occupational Skill Percentile: 1980 - 2005

Close Correspondence:
Changes in Employment Share vs. Changes in Mean Occ Age

Δ Emp Share 1980-2005

Δ Mean Age 1980-2005

Smoothed Changes in Employment by Occupational Skill Percentile 1980-2005

Where do the ‘Middle-Skill’ Workers Go? 
Autor and Dorn (2009), “This Job is Getting Old.”

- Where do the ‘middle-skill’ workers go?
  - Given declining middle, what types of jobs do workers who would have held these jobs do instead?

- Clearly, reallocation is towards the tails, but...
  - Some skill groups must be ‘moving right’ others ‘moving left.’

- Question is important for two reasons
  1. Better understanding of process of polarization
  2. Attempt to gauge how changes in occupation structure will affect job opportunities going forward for different skill levels.
Our Approach: Using Δ’s in Age Structure to Study Process of Occupational Reallocation

• Motivating observation for our empirical approach
  • Workers develop occupation-specific human capital as careers progress (Neal, 1999)

• Consequence
  • Older workers face incentive not to exit declining occupations—Sunk investment.
  • Young workers have an incentive not to enter declining occs—Poor investment.

• Empirical implication
  • Occupations will ‘get old’ as they go into decline.

• Why is this useful?
  • Offers empirical tool for measuring evolution of job opportunities.
  • Does not require panel data; Repeated cross-sections are ideal.
Are Routine-Intensive Occupations Getting Old?

\[ \Delta Y_j = \alpha + \beta_1 \Delta RTI_{j,80} + \varepsilon_j \]

<table>
<thead>
<tr>
<th>(\Delta) Mean Age</th>
<th>(\Delta) Share of Workers in Age Bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young 16-29</td>
<td>Prime 30-54</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td><strong>0.55 (0.11)</strong></td>
<td><strong>-0.015 (0.003)</strong></td>
</tr>
</tbody>
</table>

**A. OLS Model 1**

**Occ's Routine Task Intensity in 1980**

<table>
<thead>
<tr>
<th>(\Delta) Occ's Share of Total Emp (% pts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td><strong>-0.66 (0.18)</strong></td>
</tr>
</tbody>
</table>

**B. OLS Model 2**

N=330 harmonized occupations. Standard errors are in parentheses. Models are weighted by occupational shares in total hours worked in 1980. \( \sim p \leq 0.10, * p \leq 0.05, ** p \leq 0.01. \)
Relationship between Initial Routine Employment Share and Change in Routine Employment Share, 1980 – 2005

- Estimating equation at Commuting Zone level
  \[ \Delta Y_{a\tau} = \alpha_\tau + X_{a\tau} \beta_2 + \beta_3 \text{RSH}_{kt} + \epsilon_{a\tau} \]
  - Where $\Delta Y$ is change in outcome for:
    - Age group $a$
    - In commuting zone $k$
  - See also Autor and Dorn (2008), Christopher Smith (2008)

- Prediction
  1. Commuting Zones initially specialized in Routine Occupations will see differential decline in these occs during 1980 – 2005.
  2. Magnitude of decline will differ by age:
    - Largest for young, Smallest for old
### Initial Routine Emp Share and Change in Routine Emp Rate by Age and Education Group

<table>
<thead>
<tr>
<th></th>
<th>16-29</th>
<th>30-54</th>
<th>55-64</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td><strong>A. All Education Levels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of Routine Occs_{-1}</td>
<td>-0.31 **</td>
<td>-0.21 **</td>
<td>-0.25 **</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.03)</td>
</tr>
<tr>
<td><strong>B. College-Educated Workers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of Routine Occs_{-1}</td>
<td>-0.18 **</td>
<td>-0.11 **</td>
<td>-0.12 **</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.01)</td>
<td>(0.03)</td>
</tr>
<tr>
<td><strong>C. Non-College Workers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of Routine Occs_{-1}</td>
<td>-0.46 **</td>
<td>-0.28 **</td>
<td>-0.23 **</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
<td>(0.02)</td>
<td>(0.04)</td>
</tr>
</tbody>
</table>

N=2166 (3 time periods x 722 commuting zones). Each cell corresponds to a separate stacked first difference model. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period commuting zone share of national population and contain a constant and two time dummies. \( \sim p \leq 0.10, \ast p \leq 0.05, \ast\ast p \leq 0.01. \)
Reallocation Out of Routine Occupations by Age and Education Group, 1980 – 2005

Relationship between CZ's Initial Routine Occ Share and Δ Routine Emp by Age and Education, 1980 - 2005

Ages 16-29 | Ages 30-54 | Ages 55-64

College | Non-College
Measuring Reallocation into Non-Routine Occupations by Age and Education Group

• Employment in Routine-Intensive CZs is ‘hollowing out:’
  • Workers of all ages—but especially the young—are less likely to work in Routine-Intensive occupations.

• What do workers in these CZs hold instead?
  • By construction **one-third** of employment is ‘routine’
  • So, **two-thirds** of occupations are **non-routine**
  • Divide these occs into two groups based on 1980 mean wages
### Where do the Non-Routine Workers go?

#### 10 Largest High- and Low-Skill (Wage) Non-Routine Occs 1980

<table>
<thead>
<tr>
<th>A. Largest High-Wage Non-Routine Occs</th>
<th>B. Largest Low-Wage Non-Routine Occs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Production Supervisors or Foremen</td>
<td>1 Truck, Delivery, and Tractor Drivers</td>
</tr>
<tr>
<td>2 Primary School Teachers</td>
<td>2 Retail Salespersons</td>
</tr>
<tr>
<td>3 Registered Nurses</td>
<td>3 Supervisors &amp; Proprietors of Sales Jobs</td>
</tr>
<tr>
<td>4 Supervisors of Construction Work</td>
<td>4 Janitors</td>
</tr>
<tr>
<td>5 Secondary School Teachers</td>
<td>5 Farmers</td>
</tr>
<tr>
<td>6 Electricians</td>
<td>6 Health and Nursing Aides</td>
</tr>
<tr>
<td>7 Physicians</td>
<td>7 Carpenters</td>
</tr>
<tr>
<td>8 Police, Detectives, &amp; Private Detects</td>
<td>8 Automobile Mechanics</td>
</tr>
<tr>
<td>9 Subject Instructors, College</td>
<td>9 Graders and Sorters in Manufacturing</td>
</tr>
<tr>
<td>10 Industrial Machinery Repairers</td>
<td>10 Waiters and Waitresses</td>
</tr>
</tbody>
</table>
## Education and Earnings in Routine and Non-Routine Occupations

<table>
<thead>
<tr>
<th></th>
<th>Routine</th>
<th>Low-Wage Non-Routine</th>
<th>High-Wage Non-Routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of Employment in 1980</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
</tr>
<tr>
<td>Fraction College Educated in 1980</td>
<td>45%</td>
<td>27%</td>
<td>54%</td>
</tr>
<tr>
<td>Mean Wage in 1980 ($2005 dollars)</td>
<td>$12.55/hr</td>
<td>$9.87/hr</td>
<td>$17.11/hr</td>
</tr>
<tr>
<td>Mean Routine Task-Intensity in 1980</td>
<td>1.18</td>
<td>− 0.63</td>
<td>− 0.56</td>
</tr>
</tbody>
</table>
Primary Occupation Category that Expands as Routine Contracts: Low-Skill Non-Routine Occs

Relationship between CZ's Initial Routine Occ Share and Δ Non-Routine Emp by Age and Education, 1980 - 2005

- 16-29
- 30-54
- 55-64

High-Skill Non-Routine  Low-Skill Non-Routine
College-Educated Workers
Young workers moving ‘rightward,’ Older workers → ‘leftward’
Non-College Workers
Movement ‘Leftward’ for All Age Groups, Esp. Older Workers

Non-College Workers

16-29  30-54  55-64

High-Skill Non-Routine  Low-Skill Non-Routine
Comparison of Occupational Reallocation by Age and Education

College Workers

Non-College Workers
Agenda
Low Skill Work in High Skill Countries

1. ‘Polarization’ of employment
   • Some motivating facts from U.S. and OECD
   • A closer look at wage inequality trends

2. Why is low‐skilled work growing? A simple hypothesis
   • Automation and human comparative advantage

3. Evidence from U.S. regions
   • Measuring susceptibility to ‘polarization’
   • Measuring employment polarization across ‘Commuting Zones’

4. Evidence across age cohorts
   • Occupational change and age structure – What jobs do older workers occupy as occupational structure hollows out?

5. **Summary and policy conundrums**
1. **Striking polarization of employment, wage growth over two decades**
   - Technological change likely a major contributor
   - This pattern is pervasive across industrial economies—not an artifact of U.S. social policy (or the lack thereof)

2. **Plausible that polarization will continue for some time**
   - Growth of high-skill, analytical jobs
   - Growth in low-education, low-skill service jobs
   - Decline in white-collar, non-college jobs
Low Skill Work in High Skill Countries: Some Policy Challenges

1. Low wage service employment is not a good model for economic security for most workers and families
   • If service occs demand skills that are not scarce, it’s unlikely that these jobs will offer high wages or employment security.

2. Fewer rungs in the career ladder?
   • Concern that ‘good white collar jobs’—clerical and information processing—will become scarce as did high-paying blue-collar production jobs of 30 years ago.

3. Will polarization of occupations reduce economic mobility?
   • Inequality of outcomes in one generation likely contributes to inequality of opportunities in the next.
   • Not healthy for a democratic society if economic mobility—real or perceived—stagnates.