Work of the Past, Work of the Future

David H. Autor, Ford Professor of Economics, MIT and NBER
Richard T. Ely Lecture, AEA Annual Meeting
Atlanta, January 4, 2019
Starting in 1980s — Remarkable Rise of Wage Inequality by Education

1. Post-college educated
   • 80 to 100% real rise

2. Four-year college
   • 40 to 60% rise

3. High school or less
   • Real wage have fallen among men
   • Have barely budged among women
Rising Supply of Educated Workers, 1963 - 2017

Employment Shares by Education Group

Graduate Degree, 3% → 14%

College Grad, 9% → 25%

Some College, 13% → 28%

HS Graduates, 33% → 27%

HS Dropouts, 42% → 6%

Vast Increase in Supply of Educated Workers, 1960s to Present

1. College + post-college share of labor force
   • From 12% to 39%

2. Some college share
   • From 13% to 28%

3. High school or less
   • From 75% to 33%
No Simple Way to Reconcile Rising Supply of College-Educated Workers with Falling Wages of Non-College Workers — Has Productivity of Non-College Workers Fallen Despite Rising Scarcity?

Rising Supply of Educated Workers, 1963 - 2017
Employment Shares by Education Group

- Graduate Degree, 3% → 14%
- College Grad, 9% → 25%
- Some College, 13% → 28%
- HS Graduates, 33% → 27%
- HS Dropouts, 42% → 6%

Cumulative Change in Real Weekly Earnings 1963 - 2017
Working Age Adults, Ages 18 - 64

- Men
- Women

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Key Observation — Polarization of Work

High skill jobs
- **Rising** employment in professional, technical and managerial work

Low skill jobs
- **Rising** employment in personal services — Cleaning, security, recreation, health aides

Mid skill jobs
- **Falling** employment in production work, office/clerical, and sales
Most Occupational Reallocation is Upward

Mid skill jobs
- Falling employment in production work, office/clerical, and sales

High skill jobs
- Rising employment in professional, technical, and managerial work
Among College Workers Occupational Relocation is *Upward*

- Rising employment in high skill professional, technical and managerial work
- Falling employment in mid skill production work, office/clerical, and sales
- Little change in low skill employment
But among Non-College Workers, Occupational Mobility is almost Exclusively Downward

Non-college men
- Leaving middle-skill production positions

Non-college women
- Leaving middle-skill office, clerical and sales positions

All non-college adults
- Entering services: food svc, cleaning, security, hospitality & care occupations

Changes in Occupational Employment Shares, 1980-2016
Non-College (Changes in Shares in Pct Points) per Decade

- Low Skill: Health, Personal, Cleaning & Security, Operators, Laborers
- Mid Skill: Production, Clerical, Admin, Sales
- High Skill: Professional, Technical, Managerial

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Outline

I. Diverging earnings, diverging job tasks
II. The changing geography of work and wages
III. The changing geography of workers
IV. What and where is the work of the future?
Can Job Polarization Explain Diverging Wages by Education?

- Qualitatively
  - YES
- Quantitatively
  - NO
- Rise in educational inequality is...
  - Order of magnitude larger than explained by occupational reallocation
  - Wage spread has increased across occupations
IIa.
The Changing Geography of Work
College Educated Share of Working-Age Population

1950: 5 pct points
1970: 5 pct points
1980: 8 pct points
1990: 13 pct points
2000: 17 pct points
2015: 20 pct points

Urban-Rural
College Degree Gap

Share

Log Population Density (1950)
College and Post-College Shares of Working-Age Population

Log Population Density (1950)

- College Degree
- Post-College Degree

Urban-Rural Education Gap

Parallel trends for:
- Four-year degree holders
- Graduate degree holders
Occupation Shares among Working Age Adults
(Level Relative to 1980 Mean)

Low Skill: Services, Transport Construction, & Laborers
Mid Skill: Production, Clerical Administrative & Sales
High Skill: Professional Technical & Managerial

Employment share vs. Log Population Density

Mid and High Skill Work Rising in Population Density
Occupation Shares among Working Age Adults
(Level Relative to 1980 Mean)

- Low Skill: Services, Transport, Construction, & Laborers
- Mid Skill: Production, Clerical, Administrative & Sales
- High Skill: Professional, Technical & Managerial

All Workers
2000’s

Middle-Skill Work no Longer an Urban Phenomenon

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Occupation Shares among Working Age Adults
(Level Relative to 1980 Mean)

<table>
<thead>
<tr>
<th>Low Skill: Services, Transport Construction, &amp; Laborers</th>
<th>Mid Skill: Production, Clerical Administrative &amp; Sales</th>
<th>High Skill: Professional Technical &amp; Managerial</th>
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Log Population Density

Employment share

1980

2000

2015

There is Now Less Middle-Skill Work in Cities than in Metro and Rural Areas
Occupation Shares among College Adults: Some-College or Above
(Level Relative to 1980 Mean)

- Low Skill: Services, Transport, Construction, & Laborers
- Mid Skill: Production, Clerical, Administrative & Sales
- High Skill: Professional, Technical & Managerial

Employment share vs. Log Population Density

Almost No Change in Occupational Distribution of College-Educated Adults
Occupation Shares among College Adults: Some-College or Above
(Level Relative to 1980 Mean)

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Occupation Shares among College Adults: Some-College or Above
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Low Skill: Services, Transport Construction, & Laborers
Mid Skill: Production, Clerical Administrative & Sales
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Almost No Change in Occupational Distribution of College-Educated Adults

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Occupation Shares among Non-College Adults: High School or Below (Level Relative to 1980 Mean)

Low Skill: Services, Transport Construction, & Laborers

Mid Skill: Production, Clerical Administrative & Sales

High Skill: Professional Technical & Managerial

Employment share

Log Population Density

1980

Non-College Workers 1980

Mid-Skill Work Rising in Population Density, Low-Skill Work Declining
Occupation Shares among Non-College Adults: High School or Below
(Level Relative to 1980 Mean)

Low Skill: Services, Transport Construction, & Laborers

Mid Skill: Production, Clerical Administrative & Sales

High Skill: Professional Technical & Managerial

Employment share

Log Population Density

1980 ▲ 2000

Non-College Workers

2000’s

Flattening Gradients

• Becomes less positive in mid-skill work
• Becomes less negative in low-skill work

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Occupation Shares among Non-College Adults: High School or Below
(Level Relative to 1980 Mean)

- Low Skill: Services, Transport, Construction, & Laborers
- Mid Skill: Production, Clerical, Administrative & Sales
- High Skill: Professional, Technical & Managerial

Log Population Density

Employment share

2015

Non-College Workers

No Occupational Skill Gradient Remaining!

- Mid-skill work as scarce in cities as rural areas
- Low-skill work as prevalent

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The Decline of Urban Production & Clerical/Administrative Jobs
Non-College Adults (High School or Less)

Where Did the Middle Skill, Non-College Urban Jobs Go?

Production + Administrative Fall from ~40% of Jobs to ~20% of Jobs between 1980 and 2015
Occupation Shares among Non-College Adults: High School or Below
(Level Relative to 1980 Mean)

Decline of Middle Skill, Non-College Urban Work
IIb.
The Changing Geography of Work and Wages

Ongoing work with Juliette Fournier
MIT Department of Economics
Declining Urban Wage Premium among Non-College Workers

Log Real Earnings of Working-Age Adults ($2015)

College vs. Non-College Wages among Working-Age Adults

- Paralleling the Decline of Middle-Skill Urban Jobs
- Fall in the Urban Wage Premium for Non-College Workers
- Especially pronounced after 2000
Declining Urban Wage Premium among Non-College Workers

College vs. Non-College Wages among Adults Ages 25–39

- Fall in the Urban Wage premium for non-college workers
- Most pronounced for young adults, ages 25 — 39

Log hourly wage vs. Log Population Density (1950)

- Some College or Greater
- High School or Less

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Declining Urban Wage Premium among Non-College Workers
Log Real Earnings of Men and Women, Ages 40 - 54 ($2015)

College vs. Non-College
Wages among Adults Ages 40-54

- Fall in the Urban Wage premium for non-college workers
- Also highly visible for prime age adults, age 40 — 54
Falling Urban Wage Premium in Mid-Skill Occupations

Wages of Non-College Men in High skill occupations

Log hourly wage

Log Population Density (1950)

High Skill: Professional, Technical, Managerial
Falling Urban Wage Premium in Mid-Skill Occupations

Log hourly wage


Log Population Density (1950)

High: Professional, Technical, Managerial
Low: Services, Operatives & Laborers

Wages of Non-College Men in High skill & Low skill occupations

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Falling Urban Wage Premium in Mid-Skill Occupations

Wages of Non-College Men in
High skill
Low skill
& Mid-skill occupations

Collapse of urban wage premium in mid-skill occupations
Falling Urban Wage Premium in Mid-Skill Occupations

Wages of Non-College Women in High skill occupations
Falling Urban Wage Premium in Mid-Skill Occupations

Wages of Non-College Women in High skill & Low skill occupations
Falling Urban Wage Premium in Mid-Skill Occupations

Wages of Non-College Women
in High skill
Low skill
& Mid-skill occupations

Urban wage premium for mid-skill occupations persists for women — but few such jobs remain
Flattening of the Urban Wage Premium among Non-College Workers


Log hourly wage vs. Log Population Density (1950)

○ Some College or Greater  △ High School or Less

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III.
The Changing Geography of Workers

Ongoing work with Anna Salomons
Utrecht University, the Netherlands
The Inversion of the Age-Density Gradient, 1950-2010

- In 1950s, cities were five years older than rural areas.
- By 1990, no age gradient remained.
- By 2010, cities were six years younger than rural areas.

Summary, 1950 - 2010
- Rural areas aged 12 years.
- Cities aged 2 yrs.
Mean Age of Population by County 1950 to 2010

The Inversion of the Age-Density Gradient, 1950-2010

Same pattern visible when we plot mean rather than median population age.

Three potential (proximate) causes:

1. Differential fertility
2. Differential mortality
3. International and Intranational migration

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Women between 15 and 44

Natality (Unadjusted) by County 1970 to 2010

1970

1990

2010

County population density (1950)

The Inversion of the Age-Density Gradient, 1950 - 2010

- Fertility has fallen at all population densities
- Decline fairly uniform
Women between 15 and 44

Natality (Age-Adjusted) by County 1970 to 2010

The Inversion of the Age-Density Gradient, 1950-2010

- Fertility has fallen at all population densities
- Decline fairly uniform
- Age-adjusted series (this figure) looks comparable to raw series (last figure)
Mortality (Unadjusted) by County 1970 to 2010

The Inversion of the Age-Density Gradient, 1950-2010

- Mortality has fallen more in cities than in suburbs or rural areas
- This would tend to make cities older
The Inversion of the Age-Density Gradient, 1950-2010

- Mortality has fallen more in cities than in suburbs or rural areas
- This would tend to make cities older
- Age-adjustment makes clear that falling mortality not simply due to cities getting younger
The Inversion of the Age-Density Gradient, 1950-2010

Counterfactual

- Shutting down differential mortality and fertility trends
- *And* allowing actual migration
- Shows that differential mortality and fertility are unimportant
Net Migration Rate by County 1970 to 2010

NET Migration Rate by County 1970 to 2010

Age 0-17

1970

1990

2010

Net Migration Rates Across Counties

Ages 0 — 17

- Minors still moving out of cities (with their families)
- Net outmigration of young has slowed
Net Migration Rate by County 1970 to 2010

Age 18-24

Net Migration Rates Across Counties
Ages 18 — 24

- College-age young adults move to denser areas, likely often to attend college
- This has slightly steepened
Net Migration Rate by County 1970 to 2010

Age 25-39

1970  

1990  

2010  

Net Migration Rates Across Counties

Ages 25 — 39

- Young adults have historically migrated from cities (perhaps raising families)
- This has slowed substantially

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Net Migration Rate by County 1970 to 2010

Net Migration Rates Across Counties
Ages 40 — 54

- Remarkable fall in urban outmigration rate of prime-age adults
- A 50% — 75% drop relative to 1990s!
Net Migration Rate by County 1970 to 2010

Age 55-64

- Largely stable across decades

Net Migration Rates Across Counties

Ages 55 — 65
Net Migration Rate by County 1970 to 2010

Age 65 and over

1970

1990

2010

Net Migration Rates Across Counties Ages 65 and Up

- Largely stable across decades
- Some slowdown in outmigration
Net Migration Rate (Unadjusted) by County 1970 to 2010

Net Migration Rates Across Counties

Putting it All Together

- A huge decline in net migration
- Steep fall in outflows from urban to suburban + rural areas
Median Age of Population by County 1970, 1990, and 2010
Actual vs. Eliminating Intracountry Migration

1970 Actual
1990 Actual
2010 Actual

1970
1990 Counterfactual
2010 Counterfactual

The Inversion of the Age-Density Gradient, 1950 - 2010

Counterfactual

- Allowing fertility and mortality to evolve as observed
- BUT shutting down migration
- Explains the entire age inversion

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IV.

The Work of the Future
What are the Jobs of the Future?

I. Frontier Jobs
Frontier Jobs Added by Decade

- Supervisor, Word Processing ('80)
- Controller, Remotely-Piloted Vehicle ('80)
- Circuit Layout Designer ('90)
- Robotic Machine Operator ('90)
- Artificial Intelligence Specialist ('00)
- Programmer-Analyst ('00)
- Chief Information Officer ('00)
- Echocardiographer ('00)
- Molecular Physicist ('00)
- Technician, Wind Turbine ('10)
- Intelligence Analyst ('10)
What are the Jobs of the Future?

I. Frontier Jobs

II. Wealth Work
Wealth Work Jobs Added by Decade

- Hypnotherapist ('80)
- Gift Wrapper ('80)
- Fingernail Former ('90)
- Counsel'r, Marriage-Family ('90)
- Barista ('00)
- Horse exerciser ('00)
- Employee Wellness Crdnr ('00)
- Oyster Preparer ('00)
- Exercise physiologist ('10)
- Sommelier ('10)
Last Mile Jobs Added by Decade

- Check Writer ('80)
- Tamale-Machine Feeder ('80)
- Vending-Machine Attendant ('90)
- Inspector-Hand Packager ('90)
- Film Touch-Up Inspector ('90)
- Chat Room Host/Monitor ('00)
- Bicycle Messenger ('00)
- Underground utility cable locator (2010)
What are the Jobs of the Future?

I. Frontier Jobs

II. Wealth Work

III. Last Mile Jobs
Work of the Future

1. Frontier Workers
   - Programmer-Analyst

Employment Shares in New Census Job Titles (Cumulative)

Working Age Adults

Log Population Density (1950)

Frontier Workers

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Work of the Future

1. Frontier Workers
   - Programmer-Analyst

2. Wealth Workers
   - Barista
Employment Shares in New Census Job Titles (Cumulative)
Working Age Adults


- **Share**
  - **Log Population Density (1950)**

Work of the Future

1. **Frontier Workers**
   - Programmer-Analyst

2. **Wealth Workers**
   - Barista

3. **Last Mile Workers**
   - Inspector-Hand Packager
Most Prevalent Category among Men is ‘Frontier Work’

Frontier Workers
Wealth Workers
Last Mile Workers

Employment Shares in New Census Job Titles (Cumulative)
Working Age Men

Share

Log Population Density (1950)

○ Frontier Workers  ● Wealth Workers  ■ Last Mile Workers
Employment Shares in New Census Job Titles (Cumulative)

Working Age Women

Most Prevalent Category among Women is ‘Wealth Work’

Frontier Workers
Wealth Workers
Last Mile Workers
<table>
<thead>
<tr>
<th></th>
<th>All Jobs</th>
<th>Frontier Jobs</th>
<th>Wealth Work</th>
<th>Last Mile Jobs</th>
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</thead>
<tbody>
<tr>
<td>Wage ($2015)</td>
<td>$18.78</td>
<td>$26.89</td>
<td>$18.49</td>
<td>$15.29</td>
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<tr>
<td>Pct Women</td>
<td>44%</td>
<td>28%</td>
<td>62%</td>
<td>43%</td>
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<td>Pct College</td>
<td>35%</td>
<td>50%</td>
<td>41%</td>
<td>15%</td>
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<tr>
<td>Pct HS Graduate</td>
<td>26%</td>
<td>16%</td>
<td>21%</td>
<td>38%</td>
</tr>
<tr>
<td>Pct of Jobs</td>
<td>100.0%</td>
<td>5.1%</td>
<td>6.8%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>
Log Hourly Wages in New Census Job Titles (Cumulative)

Working Age Adults


Mean log hourly wage ($2015)

Log Population Density (1950)

Frontier Workers

1. Frontier Workers
   • Programmer- Analyst
Log Hourly Wages in New Census Job Titles (Cumulative)

Working Age Adults

Log Population Density (1950)

1. Frontier Workers
   • Programmer-Analyst

2. Wealth Workers
   • Barista
Log Hourly Wages in New Census Job Titles (Cumulative)  
Working Age Adults

<table>
<thead>
<tr>
<th>Year</th>
<th>Frontier Workers</th>
<th>Wealth Workers</th>
<th>Last Mile Workers</th>
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<tbody>
<tr>
<td>1980</td>
<td>Programmer-Analyst</td>
<td>Barista</td>
<td>Inspector-Hand Packager</td>
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<td>2015</td>
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Log Hourly Wages in New Census Job Titles (Cumulative) for Working Age Adults

- **1980**
- **1990**
- **2000**
- **2015**

**Log Population Density (1950)**

1. **Frontier Workers**
   - Programmer-Analyst

2. **Wealth Workers**
   - Barista

3. **Last Mile Workers**
   - Inspector-Hand Packager

4. **Average Workers**
Conclusions and Next Steps
Summary

I. Macro — Polarization of occupational structure

II. Geography — Job polarization disproportionately urban

III. Population — Young adults following the money

IV. New work — Also polarized and urban
Summary

I. Macro — Polarization of occupational structure
   • Reallocation of non-college workers
   • Out of middle-skill production and office occupations
   • Into services Hospitality, food, health, cleaning, security
Summary

I. Macro — Polarization of occupational structure

II. Geography — Job polarization disproportionately urban
   - Non-college workers used to do mid-skill work in cities
   - Urban wage premium for non-college workers disappearing
Summary

I. Macro — Polarization of occupational structure

II. Geography — Job polarization disproportionately urban

III. Population — Young adults following the money
   • Age gradient in population density has inverted
   • Young adults moving to opportunity and staying there
Summary

I. Macro — Polarization of occupational structure

II. Geography — Job polarization disproportionately urban

III. Population — Young adults following the money

IV. New work — Also polarized and urban
   • Stratum of new Frontier Jobs
     • High wage, high education, majority male
   • Larger set of Wealth Work jobs
     • Low to moderate education + wages, majority female
   • Smaller set of Last Mile jobs
     • Non-urban, v. low education, low wage
Economic and Social Policy Challenge
Economic and Social Policy Challenge

I. Concentrating opportunity in superstar cities
   • But not for less-educated workers — a critical change
Economic and Social Policy Challenge

I. Concentrating opportunity in superstar cities
   • But not for less-educated workers — a critical change

II. Structure of non-metro areas changing more slowly
   • Stable job structure, skill structure, wage structure
   • But they are getting much older
Economic and Social Policy Challenge

I. Concentrating opportunity in superstar cities
   • But not for less-educated workers — a critical change

II. Structure of non-metro areas changing more slowly
   • Stable job structure, skill structure, wage structure
   • But they are getting much older

III. Where is the work of the future?
   • It’s a great time to be young and educated
   • Not a clear ‘land of opportunity’ for non-college adults
Economic and Social Policy Challenge

I. Concentrating opportunity in superstar cities
   • But not for less-educated workers — a critical change

II. Structure of non-metro areas changing more slowly
    • Stable job structure, skill structure, wage structure
    • But they are getting much older

III. Where is the work of the future?
    • It’s a great time to be young and educated
    • Not a clear ‘land of opportunity’ for non-college adults

IV. Conjecture: Falling geo mobility reflects this new reality
Thank you
Thanking the Many Contributors to this Work

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