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

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%**

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

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
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?
Working Age Adults

Real log weekly wage (relative to 1978)

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

1970

1980

1990

2000

2015

Share

Log Population Density (1950)

Urban-Rural
College Degree Gap

- 1950: 5 pct points
- 1970: 5 pct points
- 1980: 8 pct points
- 1990: 13 pct points
- 2000: 17 pct points
- 2015: 20 pct points
College and Post-College Shares of Working-Age Population

Log Population Density (1950)

Parallel trends for
- Four-year degree holders
- Graduate degree holders

Urban-Rural Education Gap
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

1980

Mid and High Skill Work Rising in Population Density

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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
Log Population Density

1980  2000

All Workers
2000's

Middle-Skill Work
no Longer an Urban Phenomenon
Occupation Shares among Working Age Adults
(Level Relative to 1980 Mean)

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

Log Population Density

College Workers

1980

Almost No Change in Occupational Distribution of College-Educated Adults

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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

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

Almost No Change in Occupational Distribution of College-Educated Adults

© D. Autor 2019
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)

Non-College Workers
2000’s

Flattening Gradients
- Becomes less positive in mid-skill work
- Becomes less negative in low-skill work
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

2015

No Occupational Skill Gradient Remaining!
- Mid-skill work as scarce in cities as rural areas
- Low-skill work as prevalent
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
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
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

Log hourly wage

1970

1980

2000

2015

Log Population Density (1950)

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

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

Log hourly wage

Log Population Density (1950)

- High: Professional, Technical, Managerial
- Low: Services, Operatives & Laborers
- Mid: Production, Admin, Sales
Declining Urban Wage Premium among Non-College Workers

Log hourly wage

Log Population Density (1950)

- Some College or Greater
- High School or Less

Flattening of the Urban Wage Premium among Non-College Workers
III.

The Changing Geography of Workers

Ongoing work with Juliette Fournier
MIT Department of Economics
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**

Embargoed (Sorry 😞)
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

Embargoed (Sorry 😞)
Embargoed
(Sorry 😞)

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

- Fertility has fallen at all population densities
- Decline fairly uniform

Embargoed (Sorry 😞)
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)

Embargoed (Sorry 😞)
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

Embargoed
(Sorry 😞)
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

Embargoed (Sorry 😞)
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(Sorry 😞)
Embargoed
(Sorry 😞)

Net Migration Rates
Across Counties
Ages 0 — 17

• Minors still moving out of cities (with their families)
• Net outmigration of young has slowed

Embargoed
(Sorry 😞)
College-age young adults move to denser areas, likely often to attend college. This has slightly steepened.
Embargoed
(Sorry 😞)

Net Migration Rates Across Counties
Ages 25 — 39

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

Embargoed
(Sorry 😞)
Embargoed
(Sorry 😞)

Net Migration Rates Across Counties
Ages 55 — 65

- Largely stable across decades
Embargoed  
(Sorry 😞)
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

Embargoed (Sorry 😞)
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

Embargoed (Sorry 😞)
IV.

The Work of the Future

Ongoing work with Anna Salomons
Utrecht University, the Netherlands
What are the Jobs of the Future?

1. Frontier Jobs
**Robotic Systems Integration Lead**
Veo Robotics
Boston, MA
via Glassdoor

- Supervisor, Word Processing ('80)
- Controller, Remotely-Piloted Vehicle ('80)

**Integration & Test Engineer**
Veo Robotics
Boston, MA
via Glassdoor

- Circuit Layout Designer ('90)
- Robotic Machine Operator ('90)
- Artificial Intelligence Spclst ('00)
- Programmer-Analyst ('00)
- Chief Information Officer ('00)
- Echocardiographer ('00)
- Molecular Physicist ('00)

**Solutions Integration Engineer**
RightHand Robotics
Somerville, MA
via Glassdoor

- 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)
What are the Jobs of the Future?

I. Frontier Jobs

II. Wealth Work

III. Last Mile Jobs
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)
Work of the Future

1. Frontier Workers
   - Programmer-Analyst

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

Log Population Density (1950) for Frontier Workers
Employment Shares in New Census Job Titles (Cumulative) 
Working Age Adults

1. Frontier Workers
   • Programmer-Analyst

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

1. Frontier Workers
   - Programmer-Analyst

2. Wealth Workers
   - Barista

3. Last Mile Workers
   - Inspector-Hand Packager

Work of the Future

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Employment Shares in New Census Job Titles (Cumulative)

Working Age Men

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 Women

Most Prevalent Category among Women is ‘Wealth Work’

- Frontier Workers
- Wealth Workers
- Last Mile Workers

Log Population Density (1950)

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<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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<tr>
<td>Wage ($2015)</td>
<td>$18.78</td>
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<td>Pct Women</td>
<td>44%</td>
<td>28%</td>
<td>62%</td>
<td>43%</td>
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<tr>
<td>Pct College</td>
<td>35%</td>
<td>50%</td>
<td>41%</td>
<td>15%</td>
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<td>Pct HS Graduate</td>
<td>26%</td>
<td>16%</td>
<td>21%</td>
<td>38%</td>
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<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

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Log Hourly Wages in New Census Job Titles (Cumulative)

Working Age Adults

1. Frontier Workers
   • Programmer-Analyst

2. Wealth Workers
   • Barista

Wages of Workers to New Work
Log Hourly Wages in New Census Job Titles (Cumulative)

Working Age Adults

Log Population Density (1950)

1980

1990

2000

2015

Mean log hourly wage ($2015)

Log Population Density (1950)

1. Frontier Workers
   • Programmer-Analyst

2. Wealth Workers
   • Barista

3. Last Mile Workers
   • Inspector-Hand Packager

Wages of Workers to New Work

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Log Hourly Wages in New Census Job Titles (Cumulative)

Working Age Adults

1980

1990

2000

2015

Mean log hourly wage ($2015)

Log Population Density (1950)

1. Frontier Workers
   • Programmer-Analyst

2. Wealth Workers
   • Barista

3. Last Mile Workers
   • Inspector-Hand Packager

4. Average Workers

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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

<table>
<thead>
<tr>
<th>Advisors &amp; Mentors</th>
<th>Coauthors</th>
<th>Students &amp; Researchers</th>
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<td>Pian Shu</td>
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### Declining Urban Wage Premium among Non-College Workers


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<td>Wage</td>
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<td>2.8</td>
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#### Employment Shares in New Census Job Titles (Cumulative)

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<tr>
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<td>0.02</td>
<td>0.04</td>
<td>0.06</td>
<td>0.08</td>
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<tr>
<td>Wealth Workers</td>
<td>0.02</td>
<td>0.04</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Last Mile Workers</td>
<td>0.02</td>
<td>0.04</td>
<td>0.06</td>
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</table>

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

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Employment share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Skill: Services, Transport</td>
<td>0.02</td>
</tr>
<tr>
<td>Mid Skill: Production, Clerical</td>
<td>0.04</td>
</tr>
<tr>
<td>High Skill: Professional</td>
<td>0.06</td>
</tr>
</tbody>
</table>

#### 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