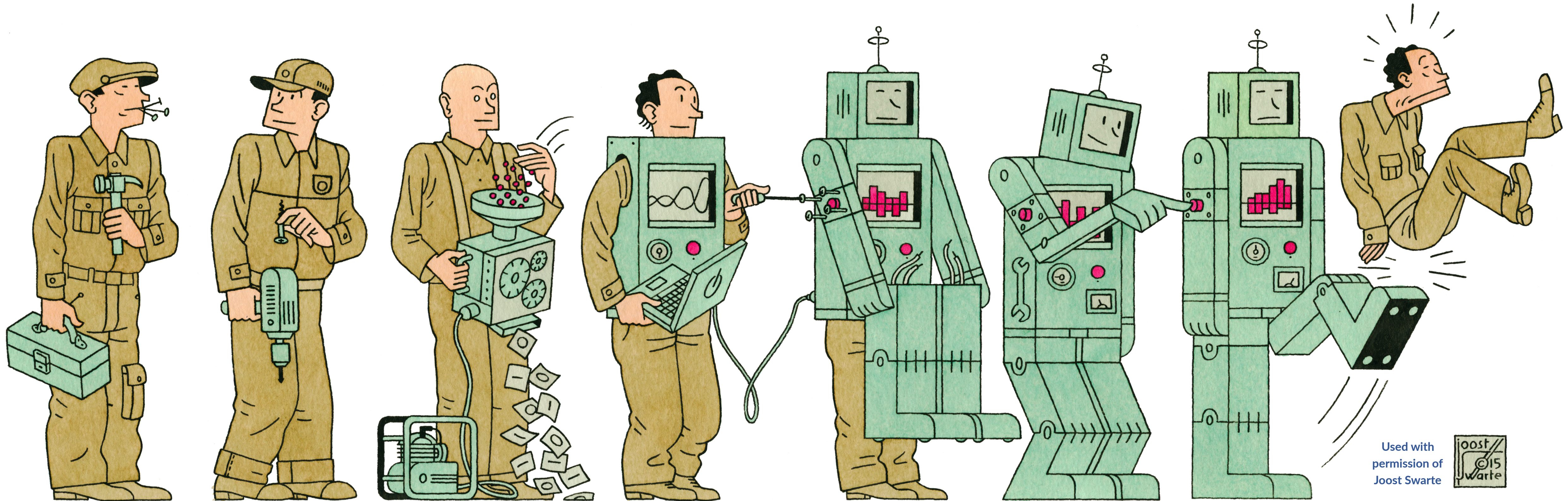


# Work of the Past, Work of the Future



Used with  
permission of  
Joost Swarte



David H. Autor, Ford Professor of Economics  
Co-Chair, MIT Work of the Future Task Force  
ECB Challenges in the Digital Age, 4 July 2019

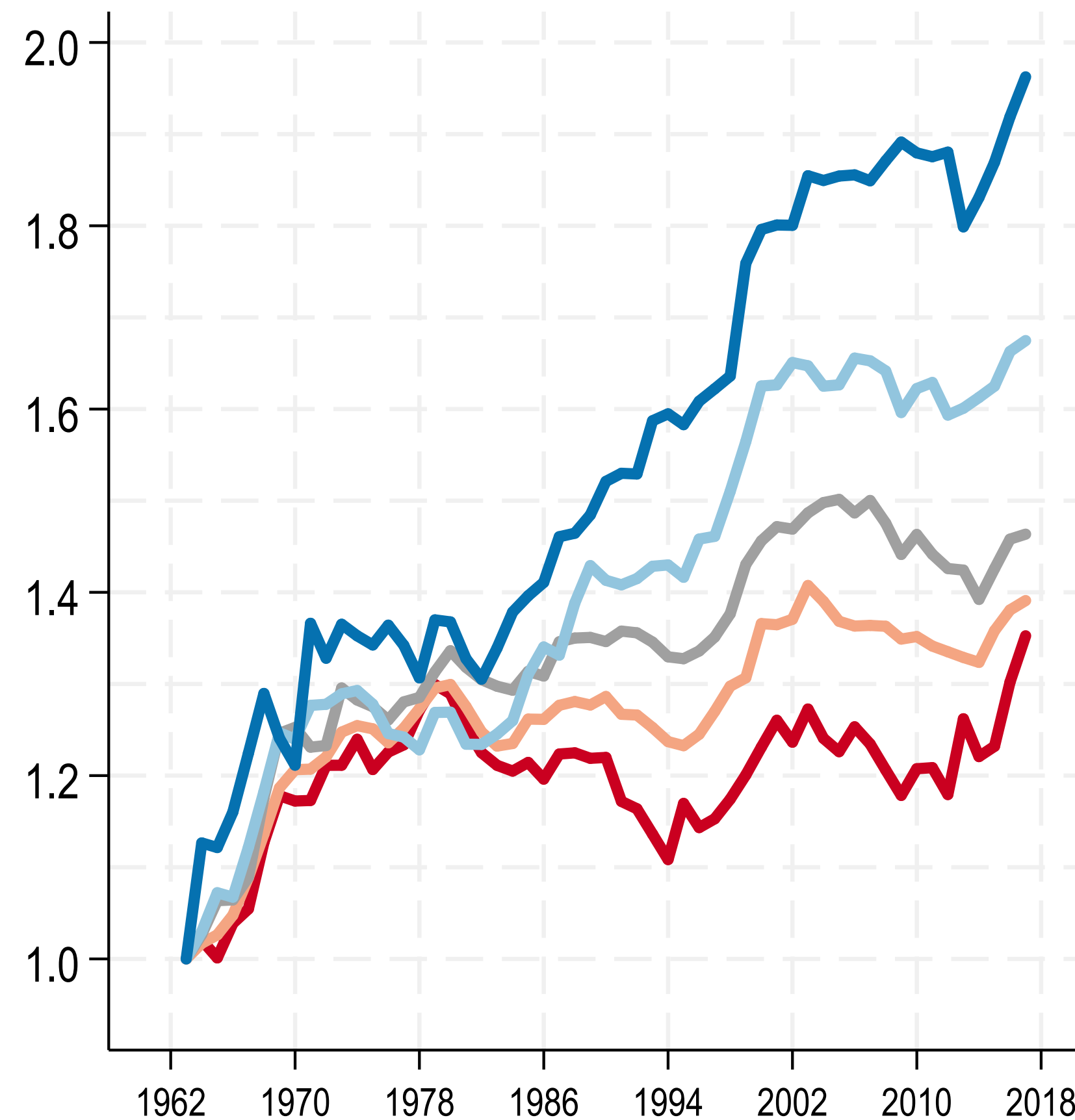
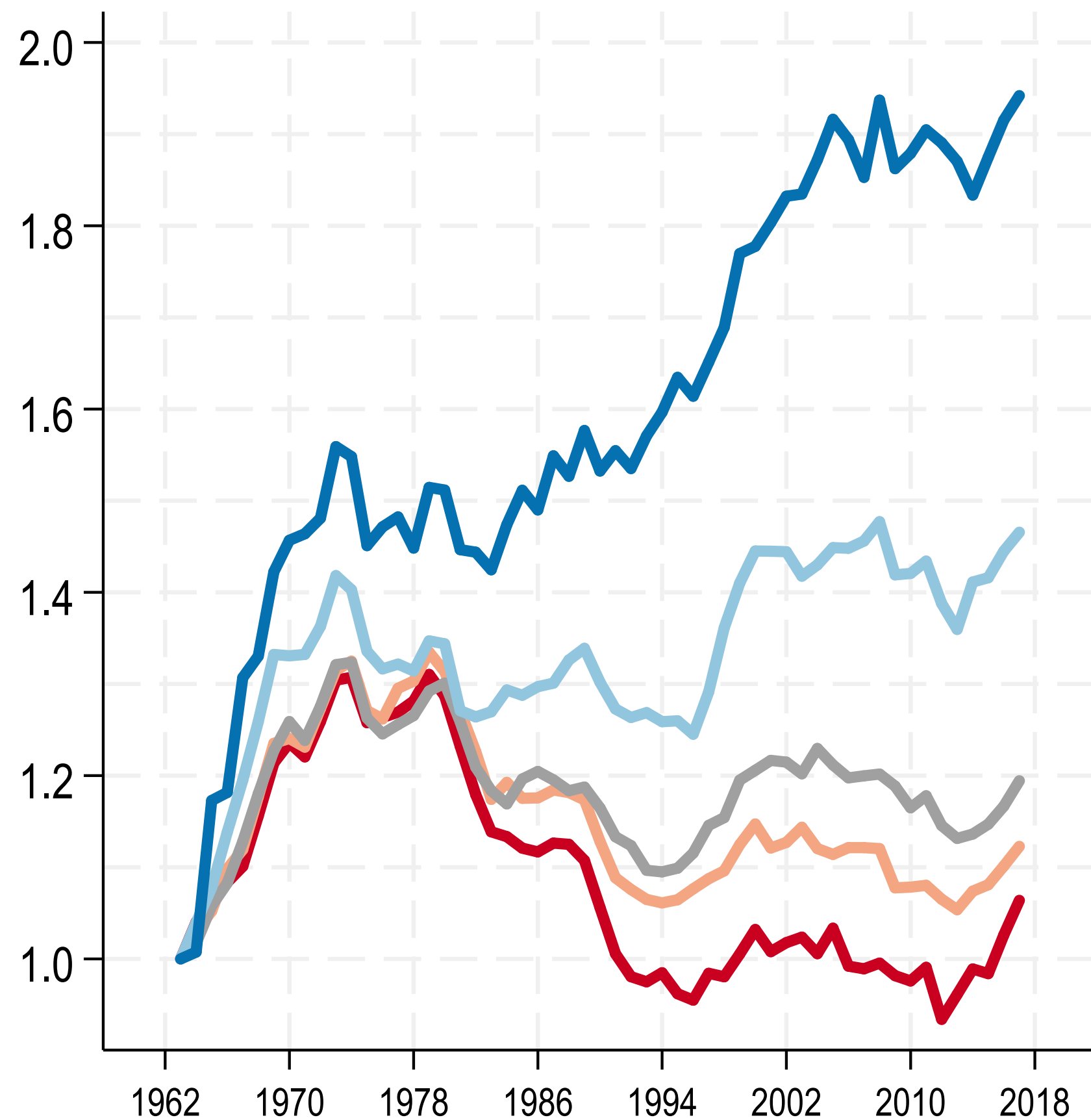
# Cumulative Change in Real Weekly Earnings 1963 - 2017

Working Age Adults, Ages 18 - 64

**Starting in 1980s —  
Remarkable Rise of Wage  
Inequality by Education**

Men

Women



**1. Post-college educated**

- 80 to 100% real rise

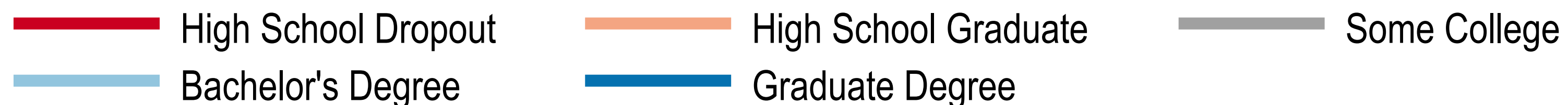
**2. Four-year college**

- 40 to 60% rise

**3. High school or less**

- Real wage have *fallen* among men

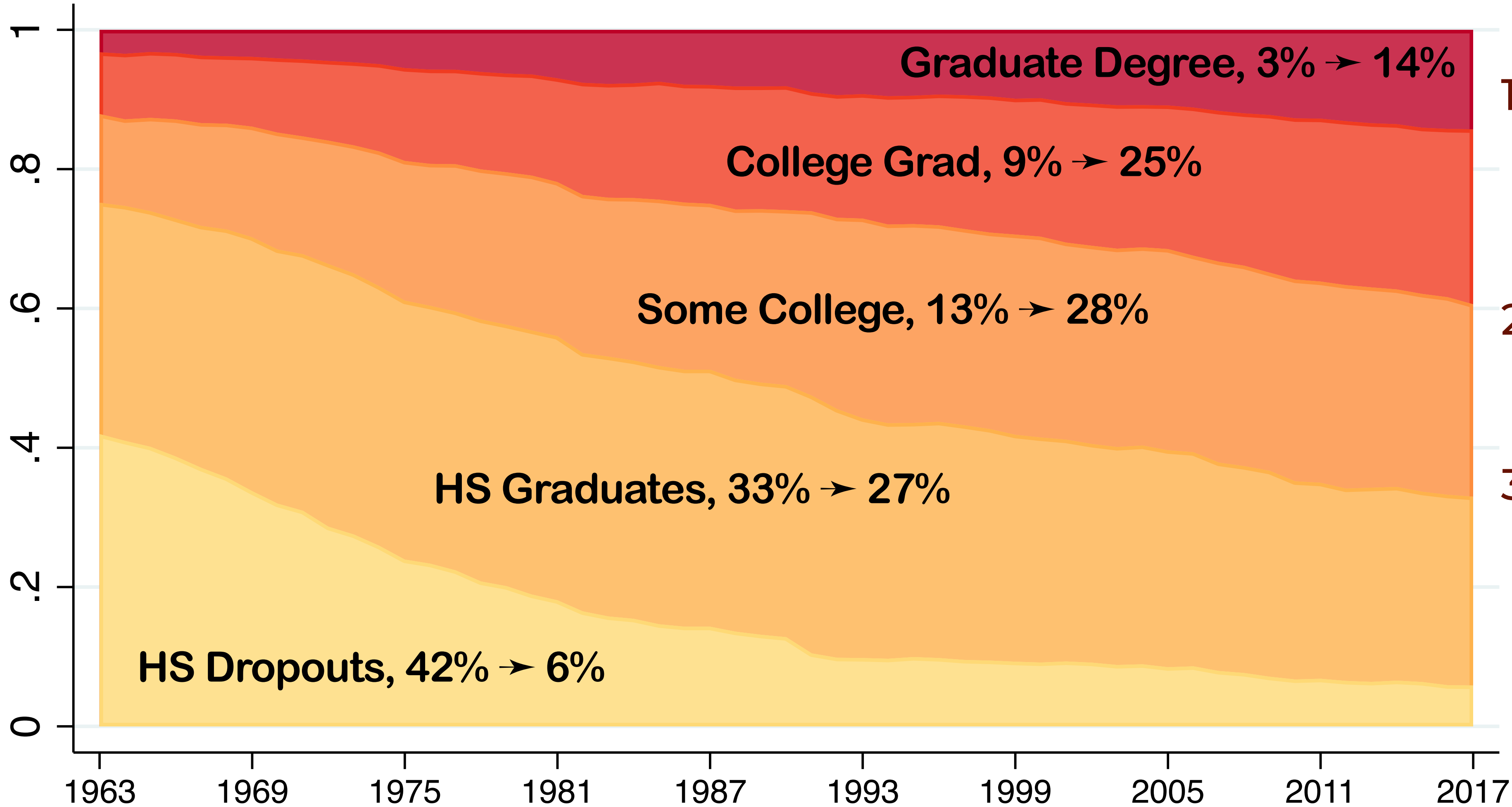
- Have *barely budged* among women



# Rising Supply of Educated Workers, 1963 - 2017

## Employment Shares by Education Group

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

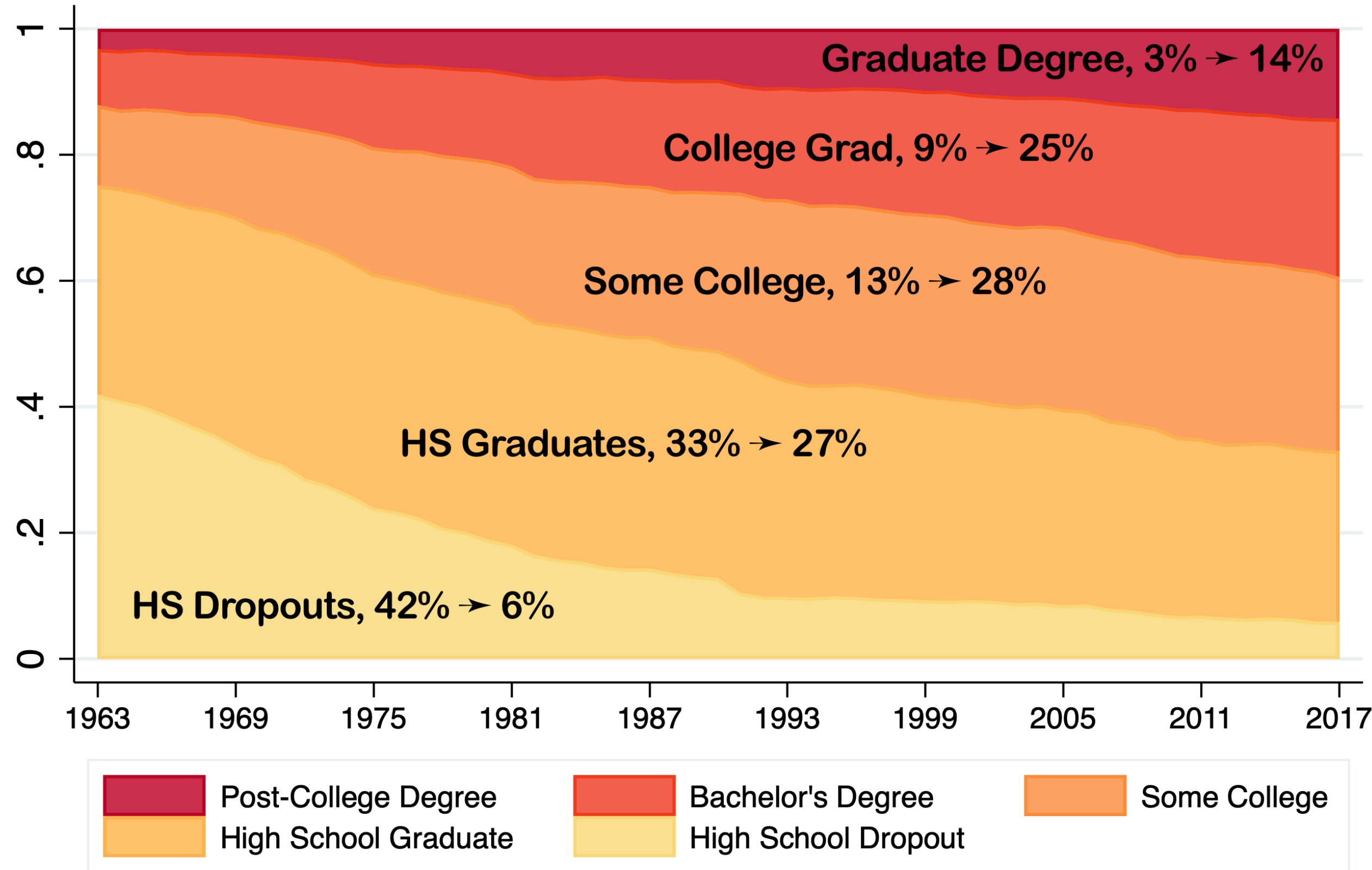


1. College + post-college share of labor force
  - From 12% to 39%
2. Some college share
  - From 13% to 28%
3. High school or less
  - From 75% to 33%

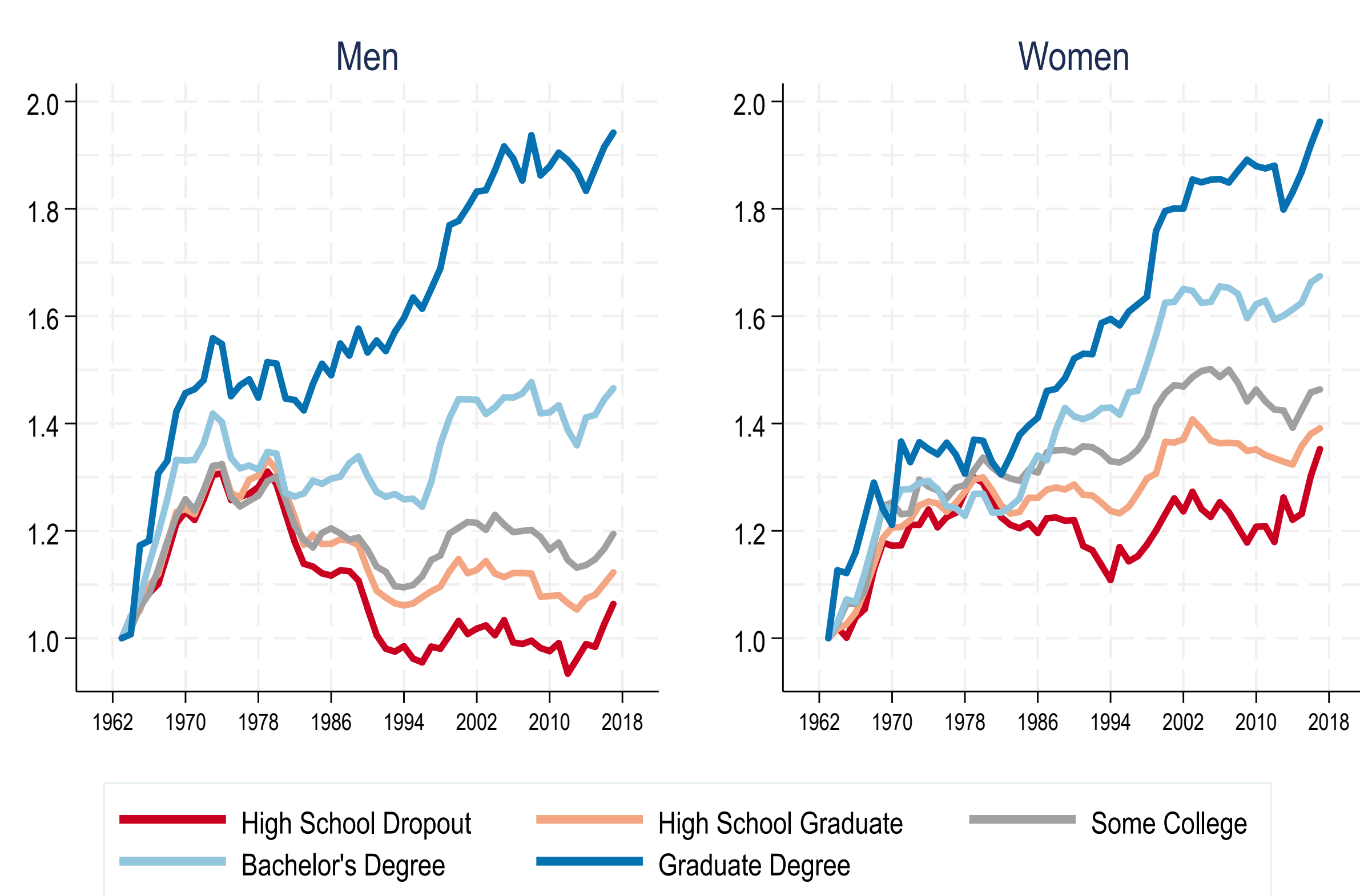


# No Simple Way to Reconcile Rising Supply of College-Educated Workers with Falling Wages of Non-College Workers – Has Productivity of Non-College Workers Fallen Despite Rising Scarcity?

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

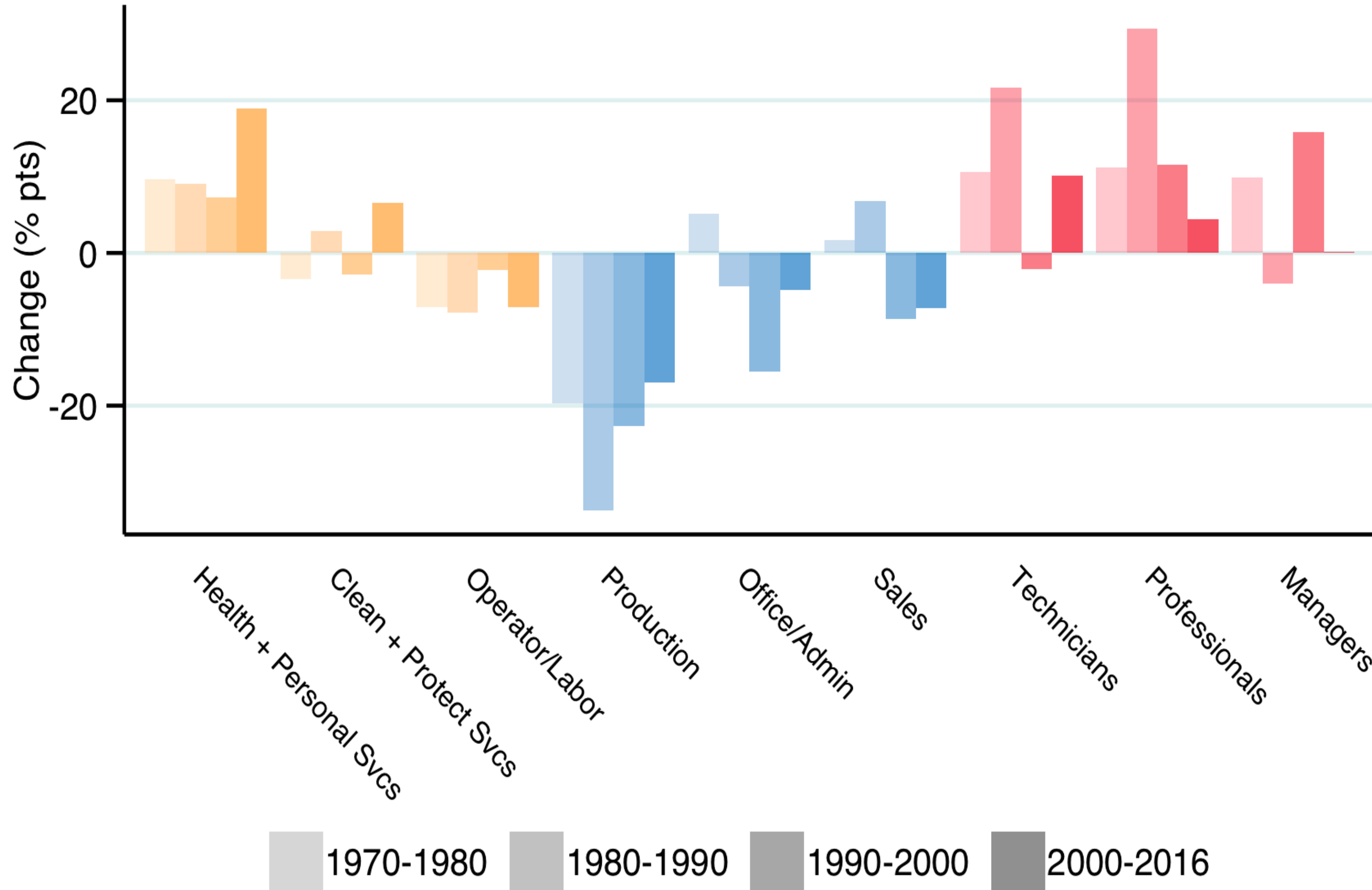


Cumulative Change in Real Weekly Earnings 1963 - 2017  
Working Age Adults, Ages 18 - 64



# Changes in Occupational Employment Shares, 1970-2016

Working Age Adults (Percent Change Over Decade)



## Key Observation — Polarization of Work

### High skill jobs

- **Rising** employment in professional, technical and managerial work

### Low skill jobs

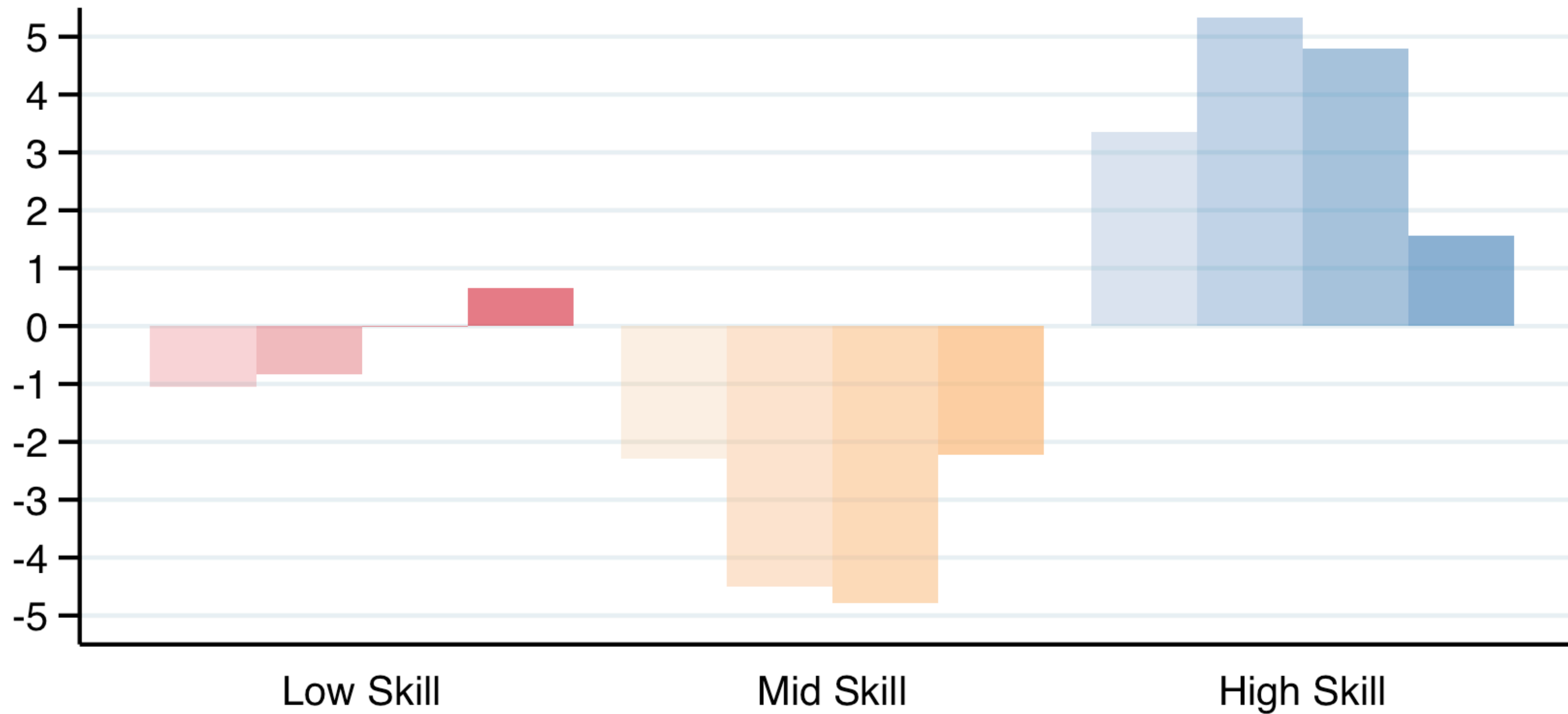
- **Rising** employment in personal services — Cleaning, security, recreation, health aides

### Mid skill jobs

- **Falling** employment in production work, office/clerical, and sales

# Changes in Occupational Employment Shares, 1970-2016

Working Age Adults (Changes in Shares in Pct Points) per Decade



Health, Personal, Cleaning & Security, Operators, Laborers    Production, Clerical, Admin, Sales    Professional, Technical, Managerial

1970-1980    1980-1990    1990-2000    2000-2016

**Most Occupational Reallocation is Upward**

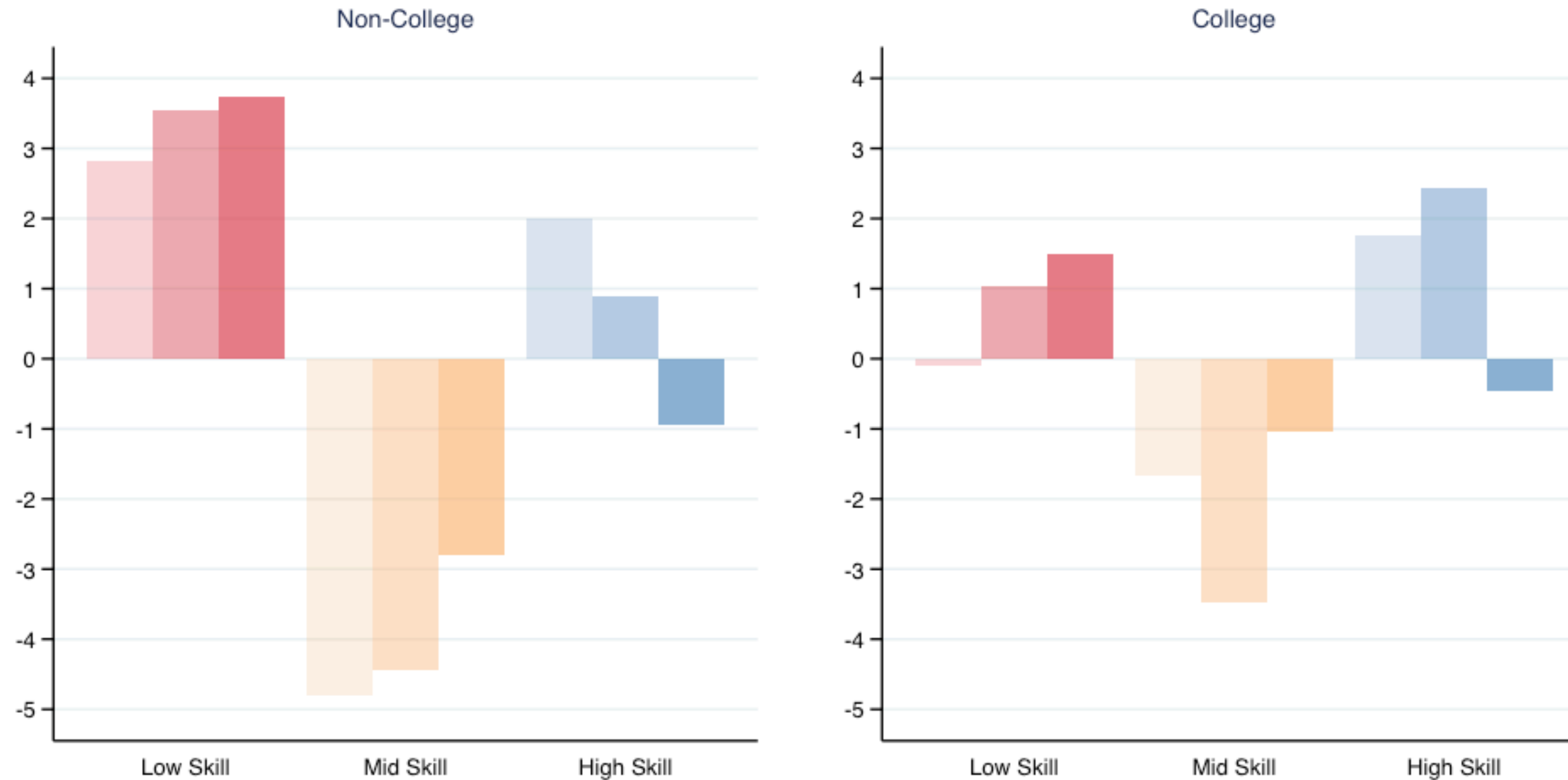
## Mid skill jobs

- 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 among Working Age Adults, 1980-2016



■ Health, Personal, Cleaning & Security, Operators, Laborers
 ■ Production, Clerical, Admin, Sales
 ■ Professional, Technical, Managerial

■ 1980-1990
 ■ 1990-2000
 ■ 2000-2016

**Among College Workers Most Occupational Relocation is *Upward***

**But among Non-College Workers, Occupational Mobility is almost Exclusively *Downward***

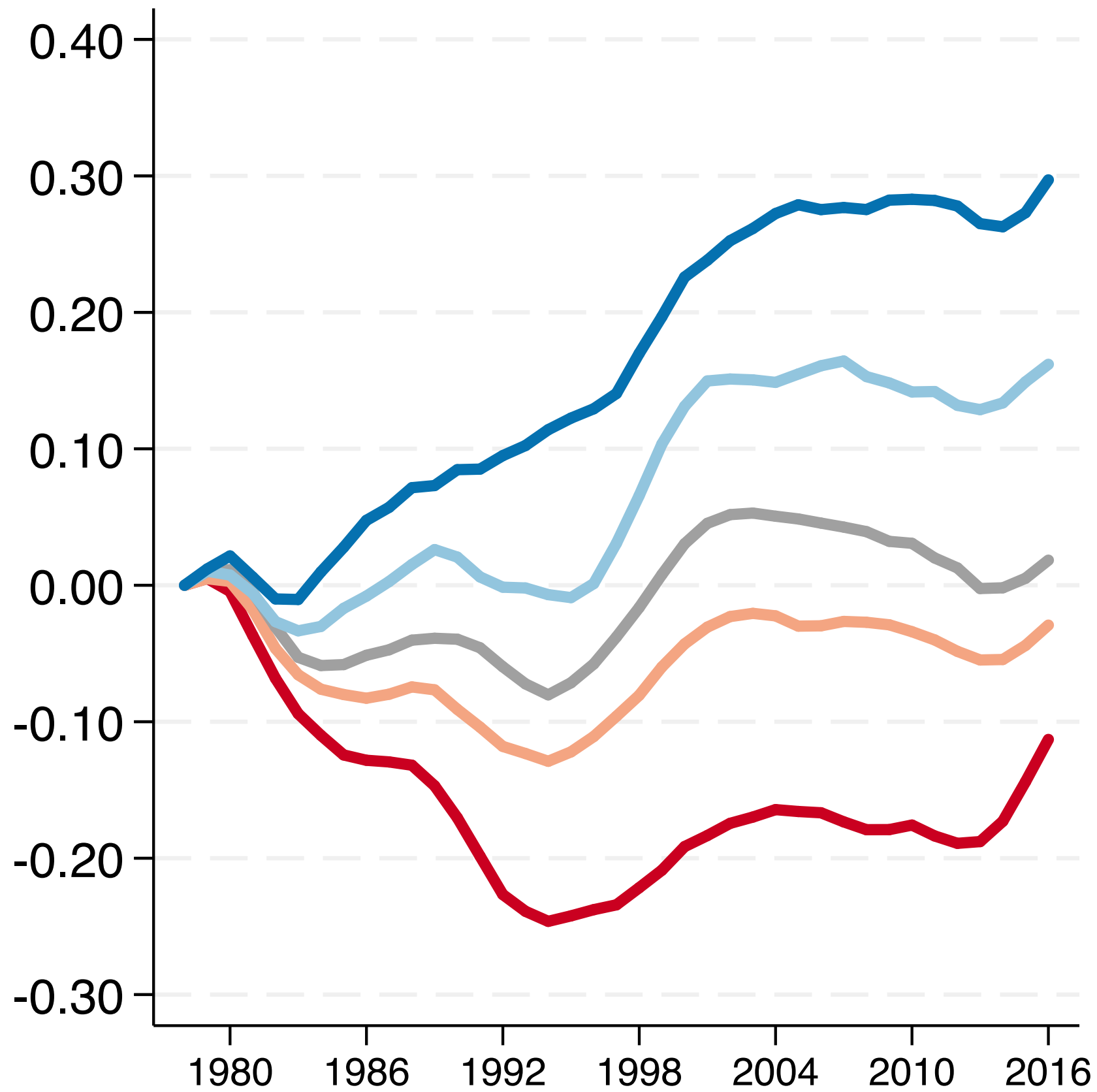
# Actual v. Counterfactual Real Weekly Wage Growth, 1978-2016

## Working Age Adults

Real log weekly wage (relative to 1978)

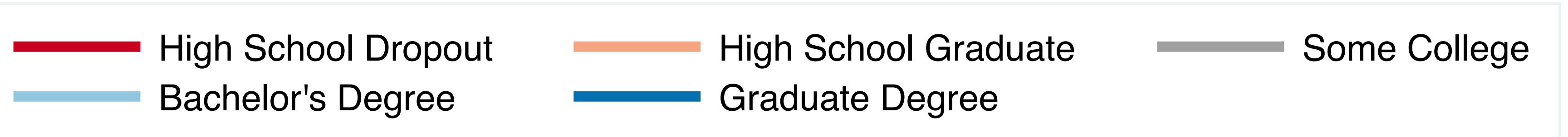
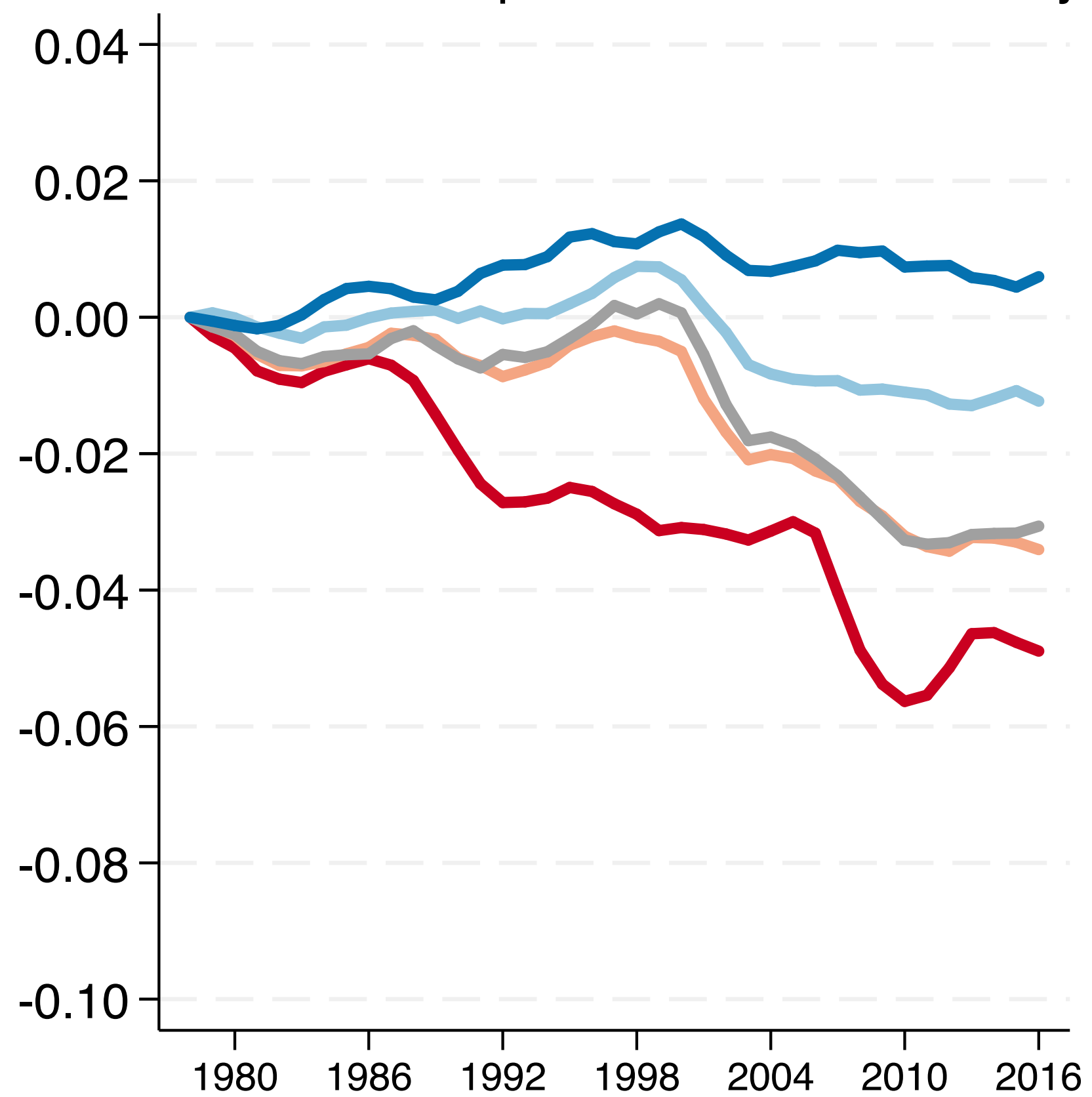
### Actual Wage Changes

Btwn Occ Reallocation + w/in Occ Wage Change



### Counterfactual Wage Changes

Between Occupation Reallocation Only



## 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



# Outline

- I. The changing geography of **work**
- II. The changing geography of **wages**
- III. The changing geography of **workers**
- IV. What and **where** is the **work** of the future?

I.

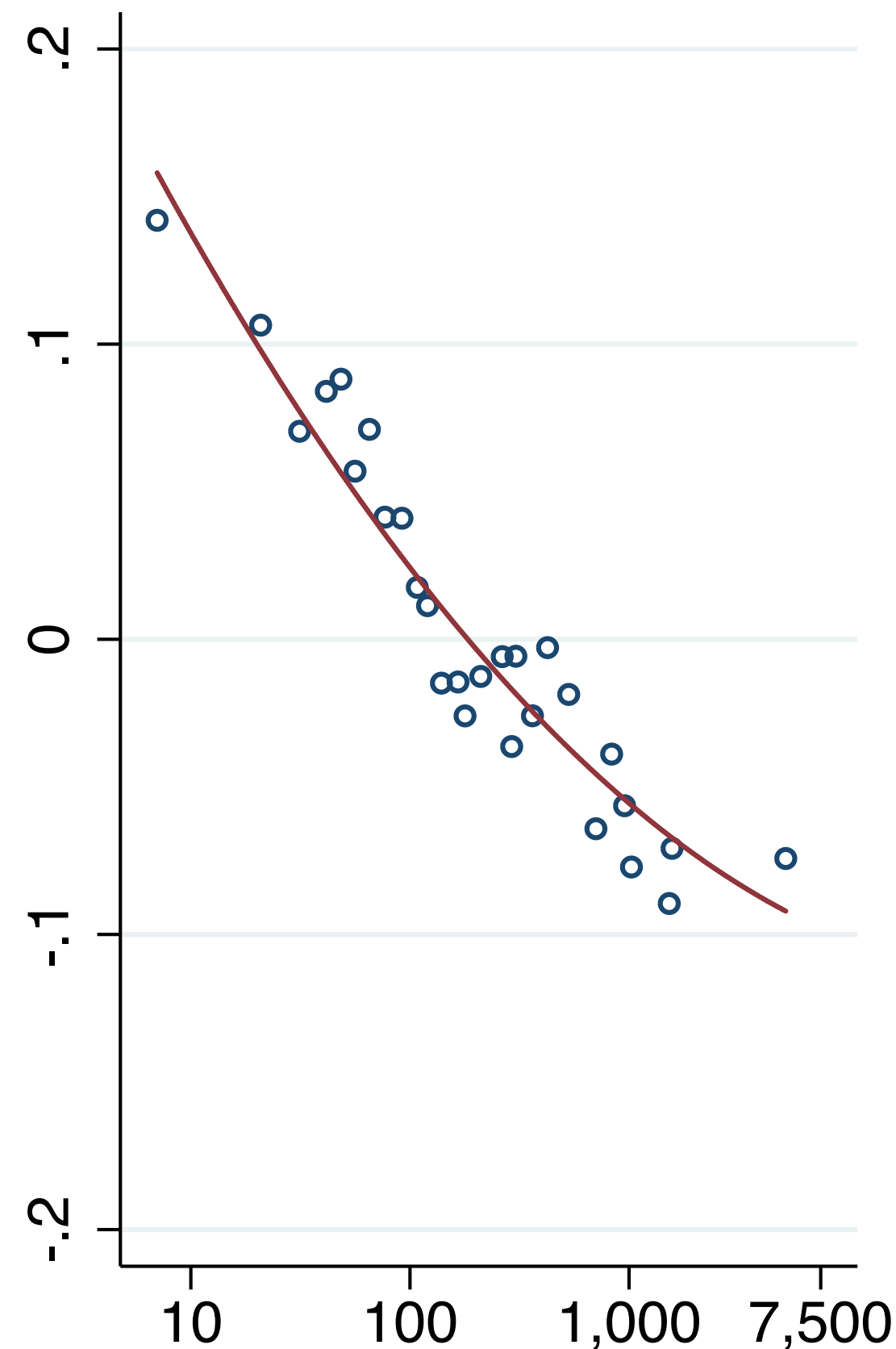
The Changing Geography  
of Work

# Occupation Shares among Non-College Adults: High School or Below (Level Relative to 1970 Mean)

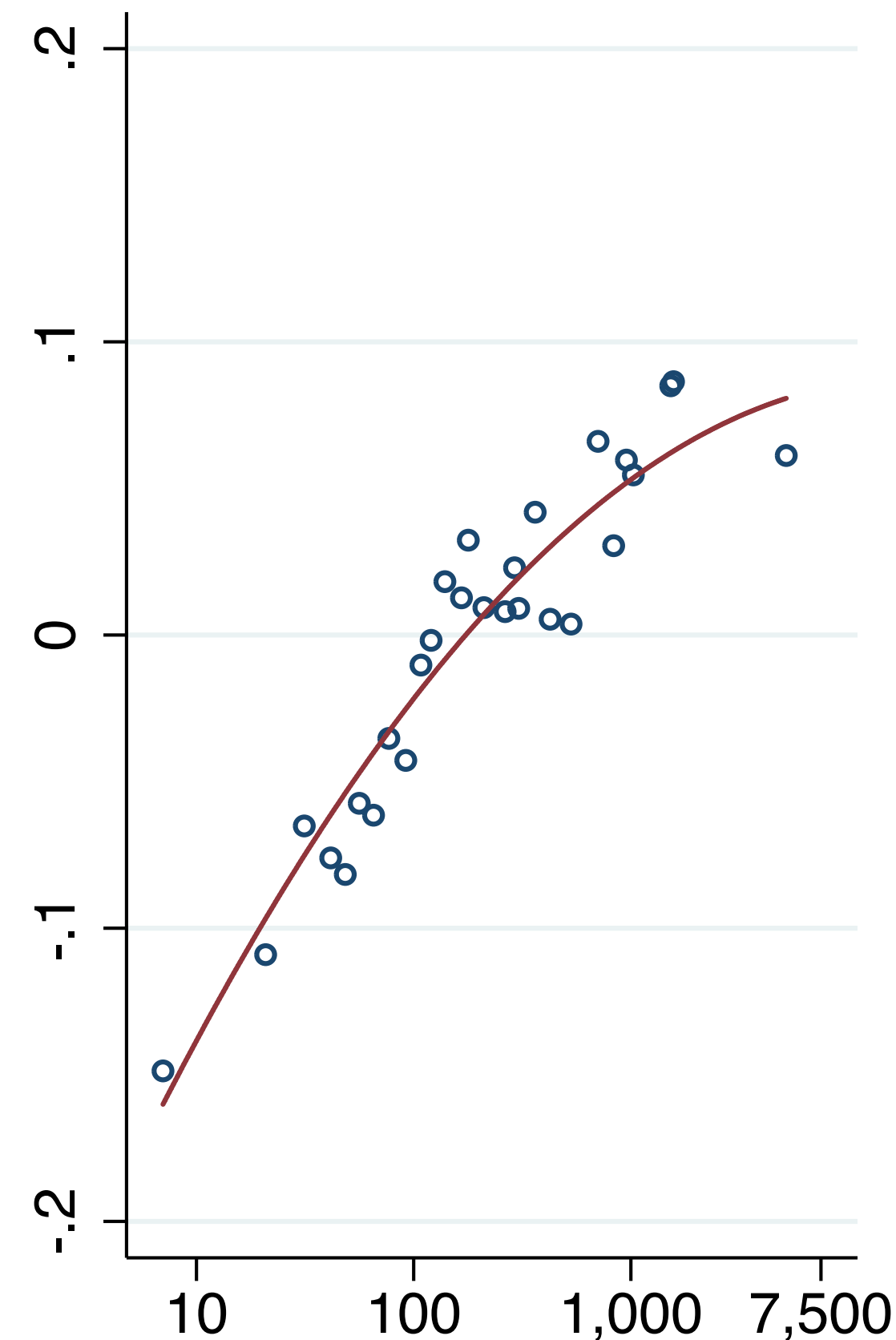
# Non-College Workers

1970

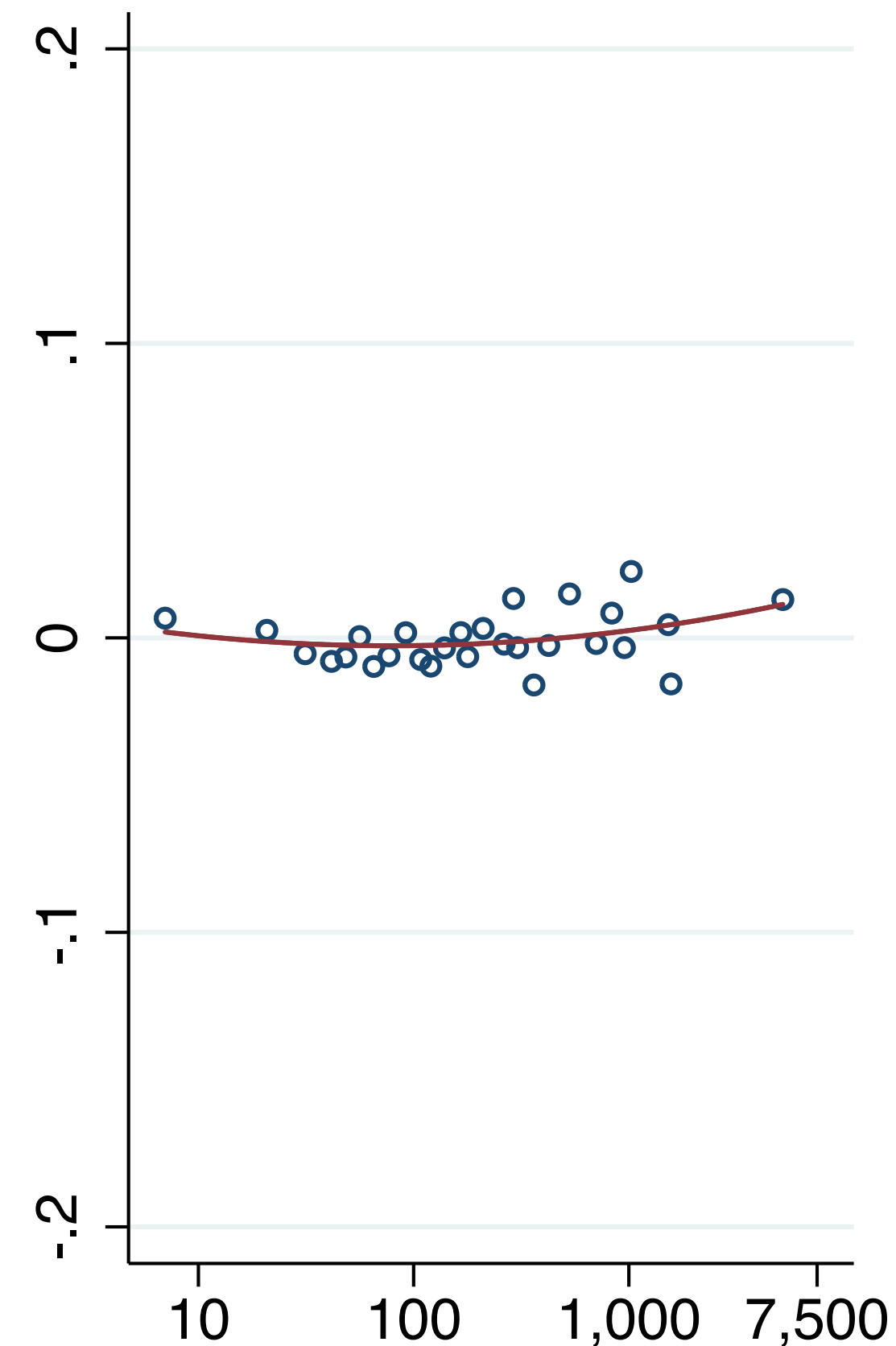
Low Skill: Services, Transport  
Construction, & Laborers



Mid Skill: Production, Clerical  
Administrative & Sales



High Skill: Professional  
Technical & Managerial



Log Population Density

○ 1970

**Mid-Skill Work  
Steeply Rising in  
Population Density,  
Low-Skill Work  
Steeply Declining**

# Occupation Shares among Non-College Adults: High School or Below (Level Relative to 1970 Mean)

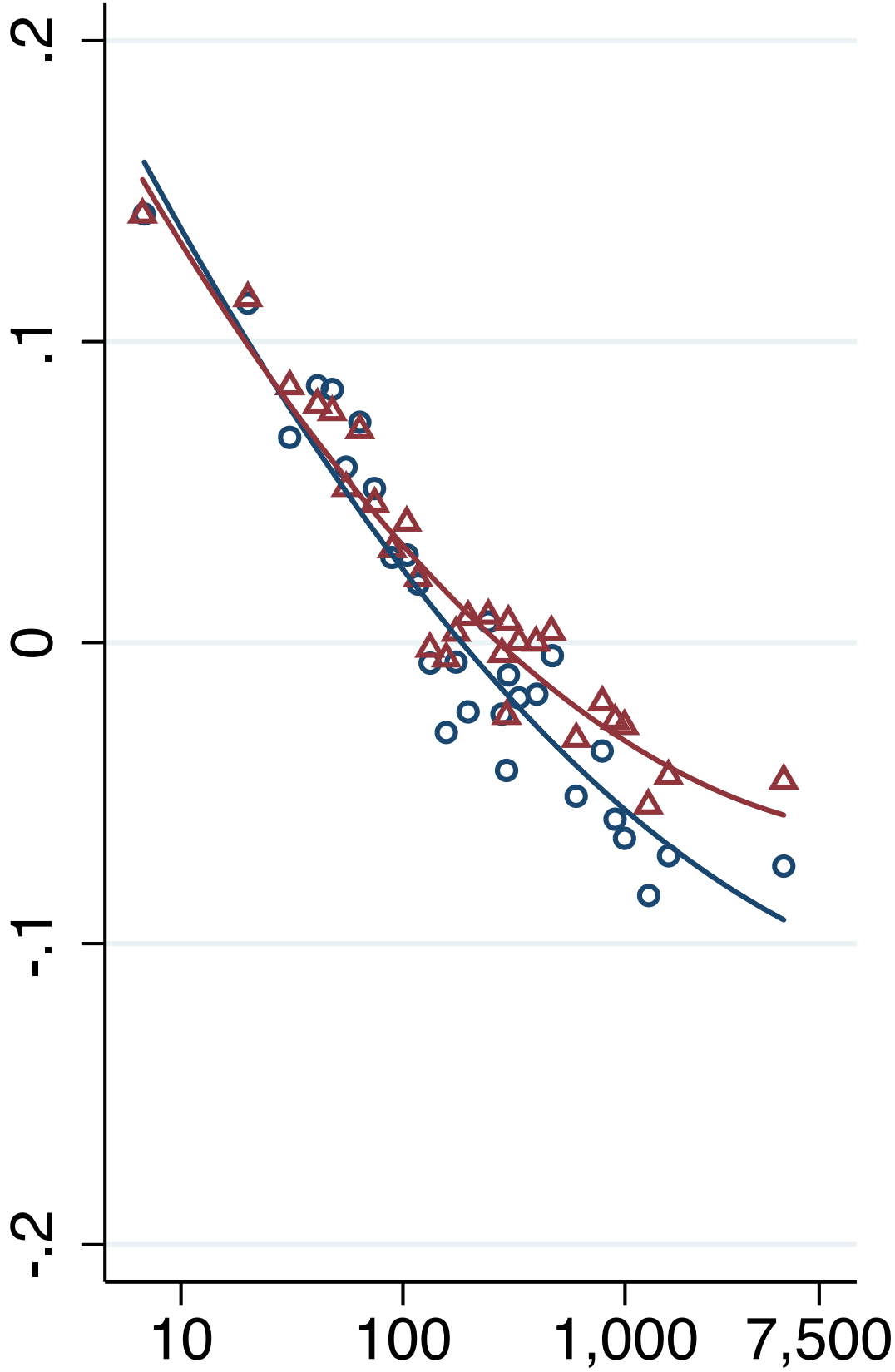
# Non-College Workers

1970 + 80

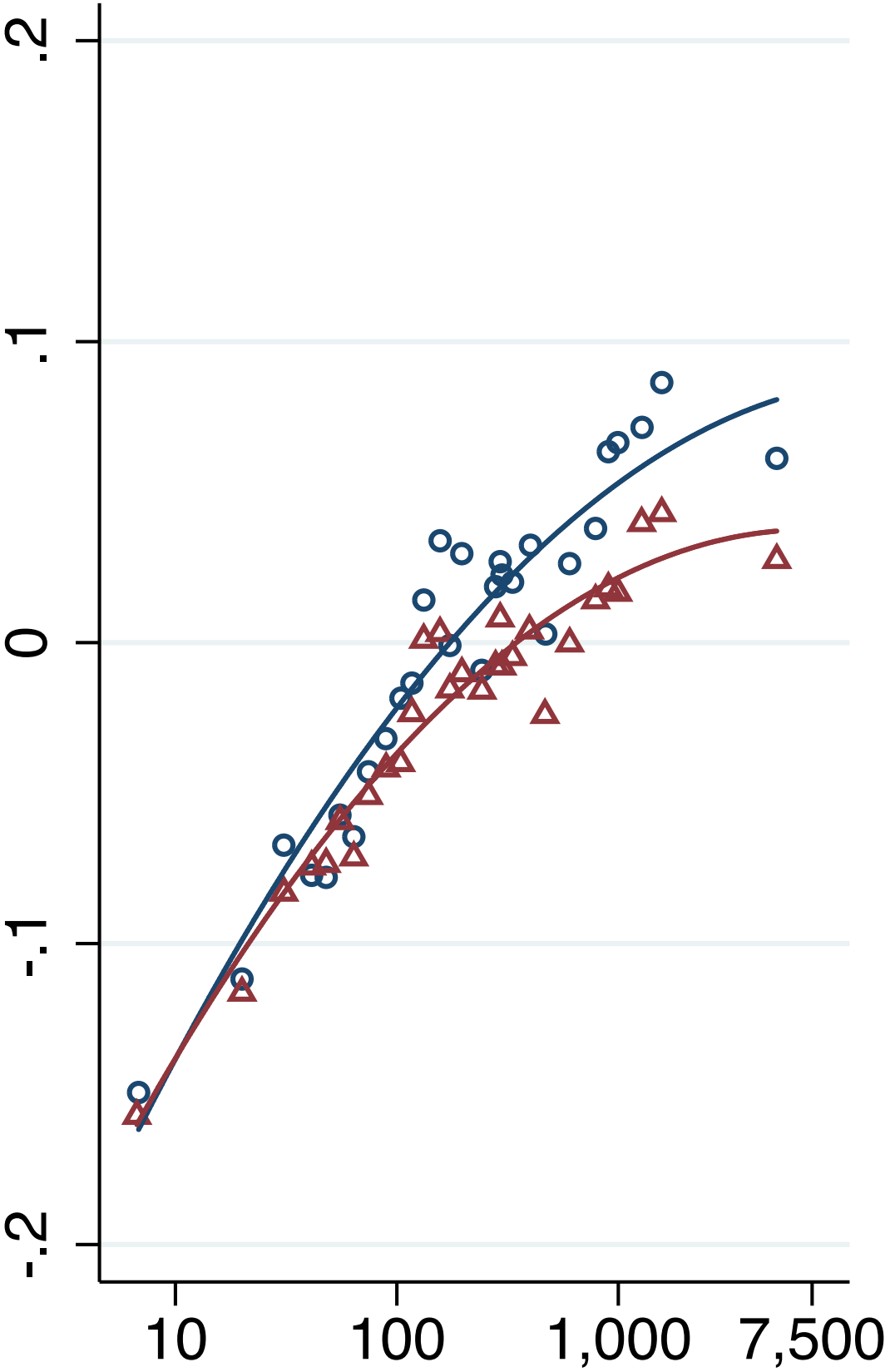
## Flattening Gradients

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

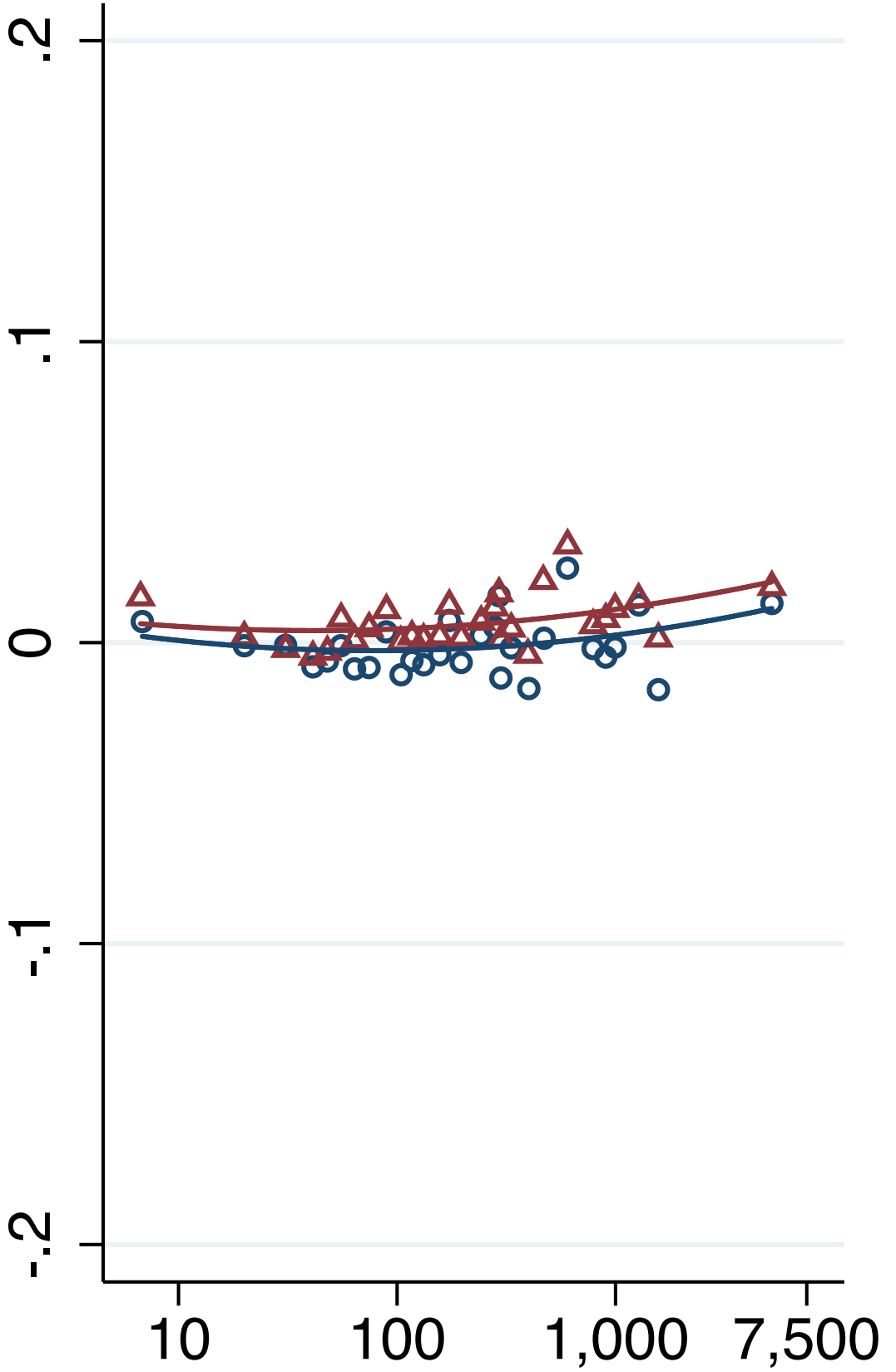
Low Skill: Services, Transport  
Construction, & Laborers



Mid Skill: Production, Clerical  
Administrative & Sales



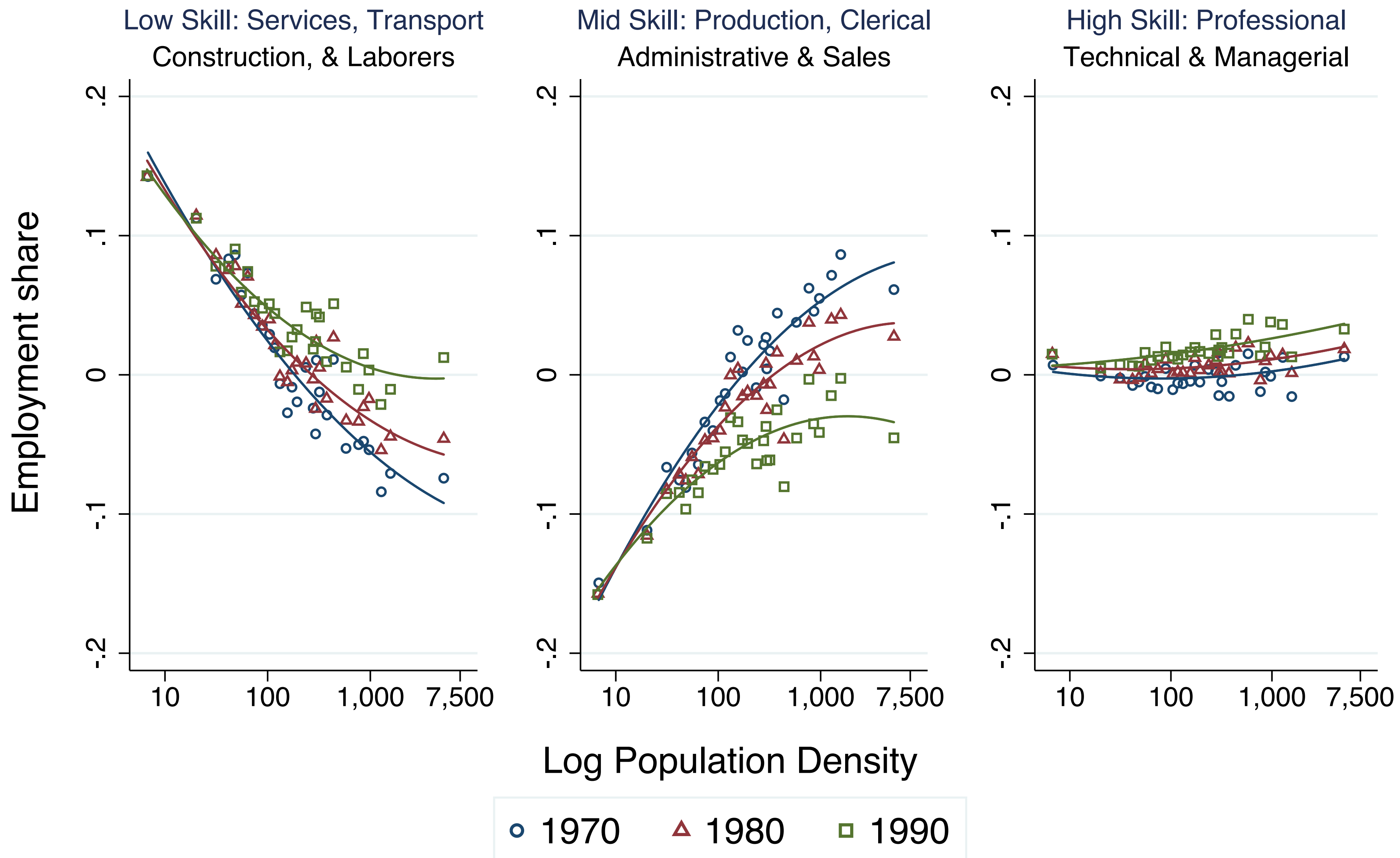
High Skill: Professional  
Technical & Managerial



Log Population Density

○ 1970    △ 1980

# Occupation Shares among Non-College Adults: High School or Below (Level Relative to 1970 Mean)



# Non-College Workers

1970 +  
80 + 90

## Flattening Gradients

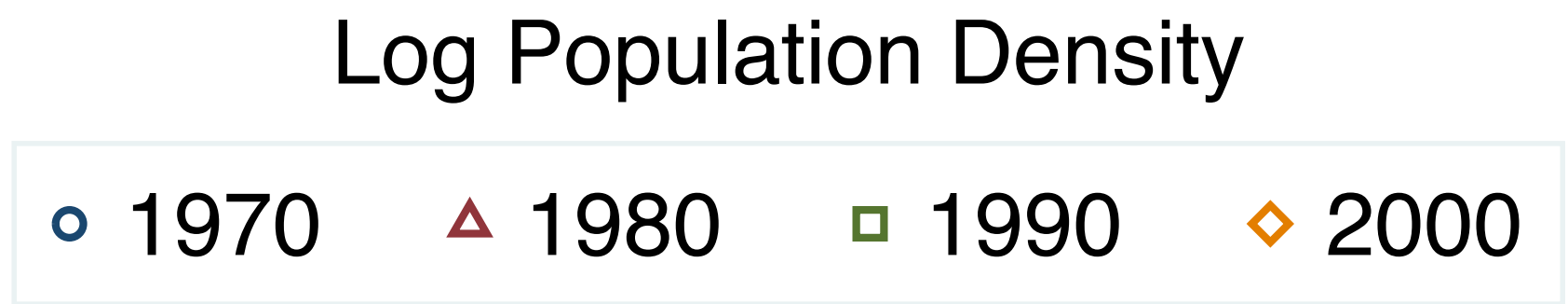
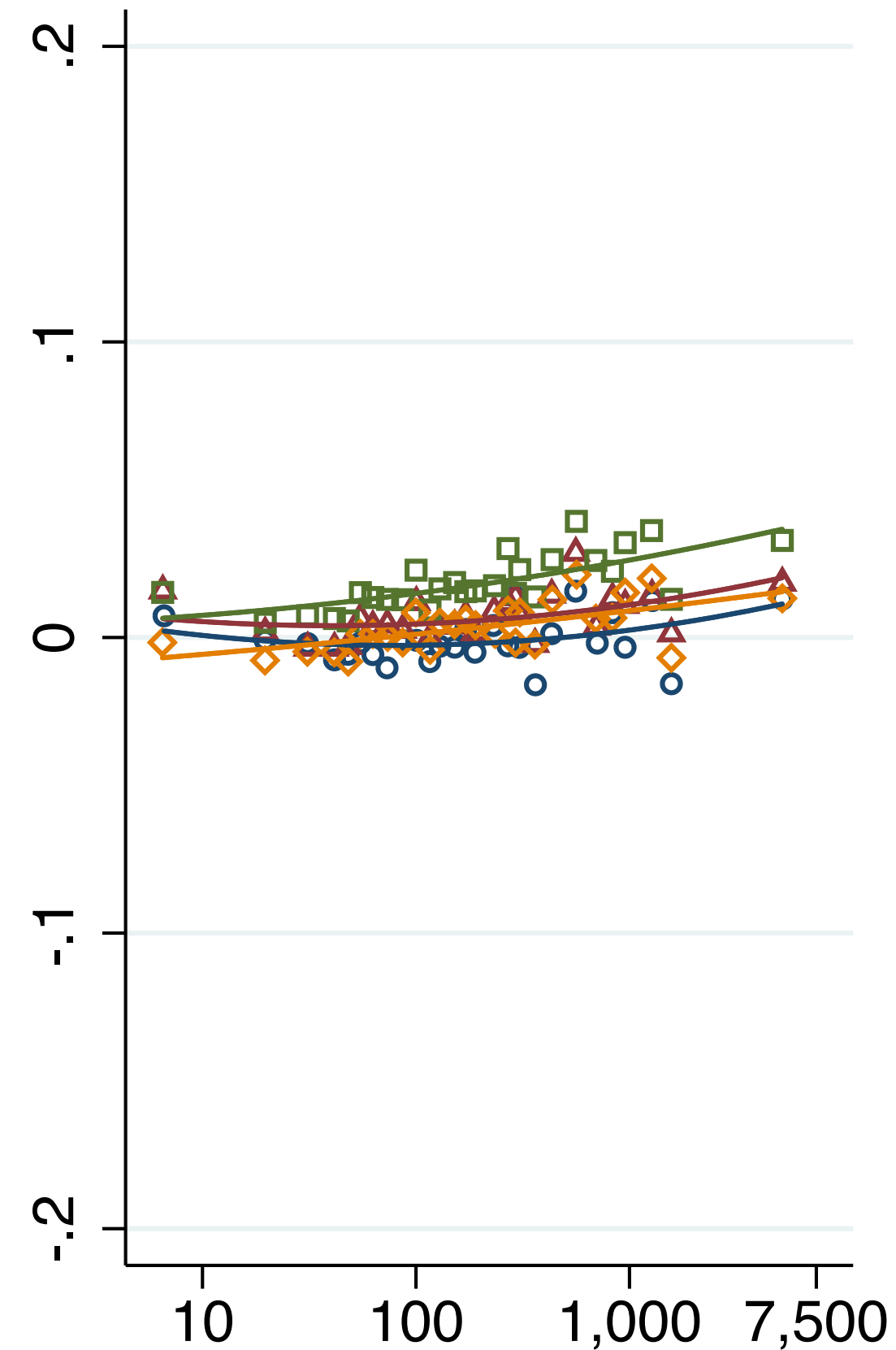
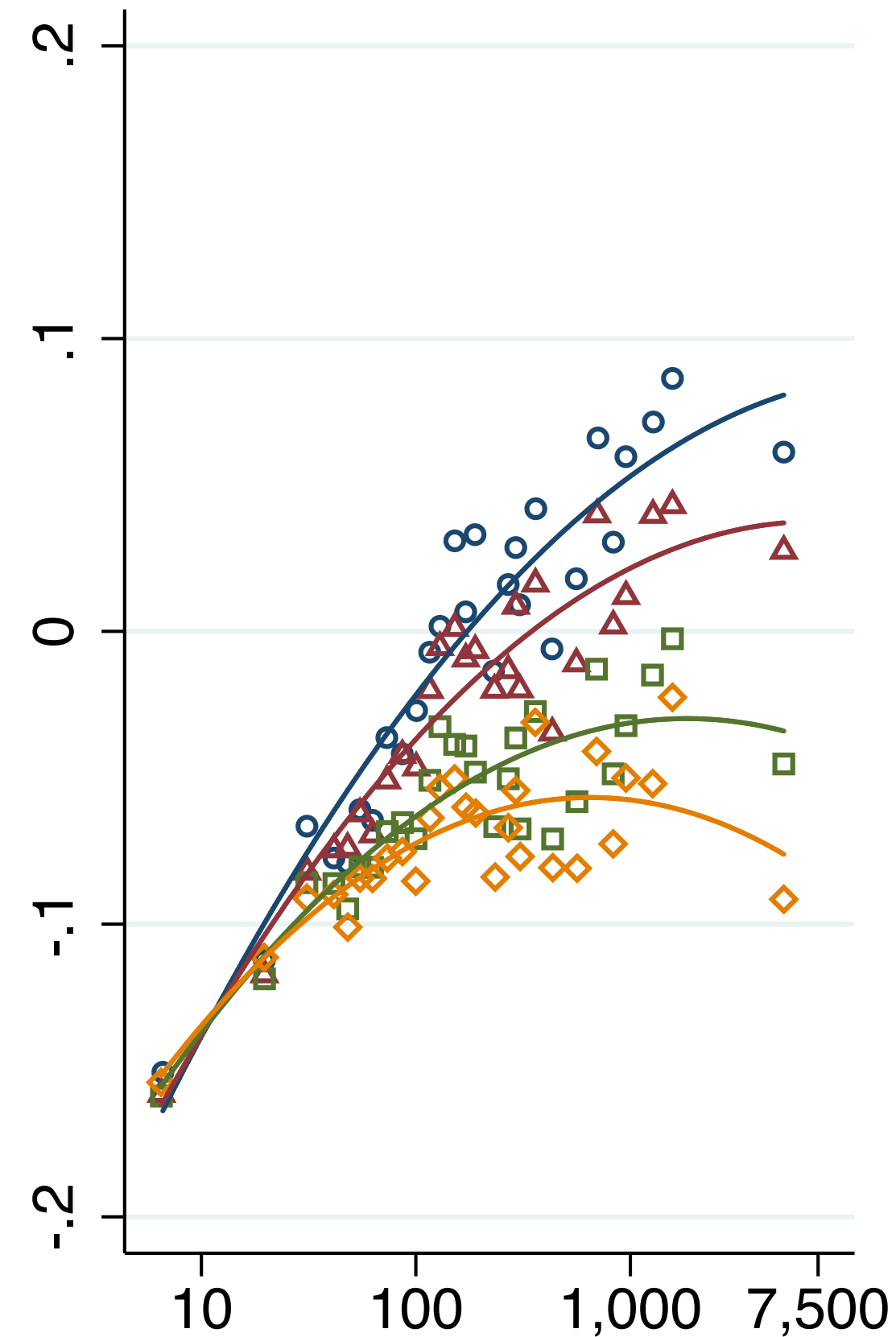
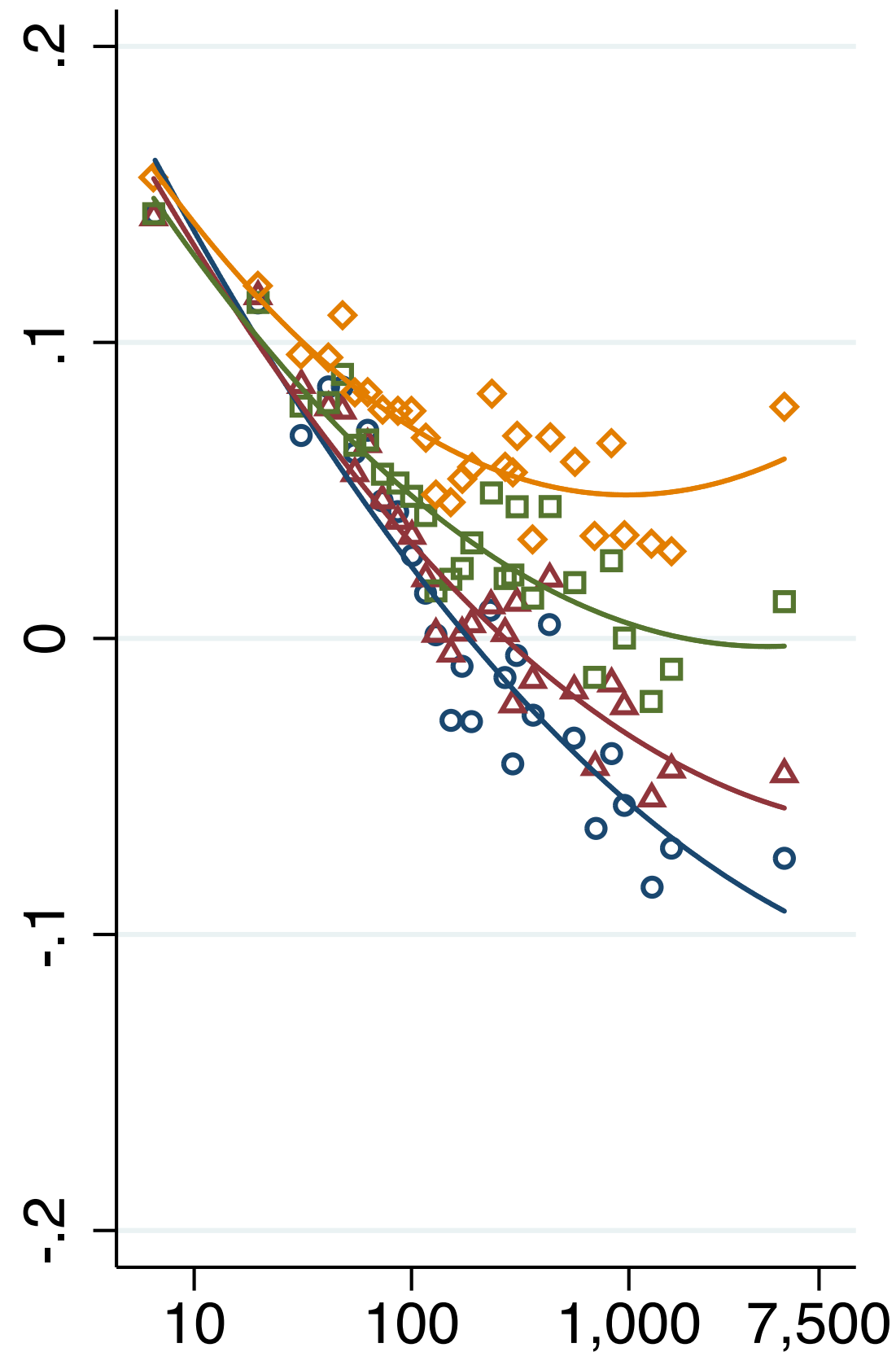
- Becomes **less positive** in mid-skill work
- Becomes **less negative** in low-skill work

# Occupation Shares among Non-College Adults: High School or Below (Level Relative to 1970 Mean)

Low Skill: Services, Transport  
Construction, & Laborers

Mid Skill: Production, Clerical  
Administrative & Sales

High Skill: Professional  
Technical & Managerial



# Non-College Workers

1970 +

80 + 90

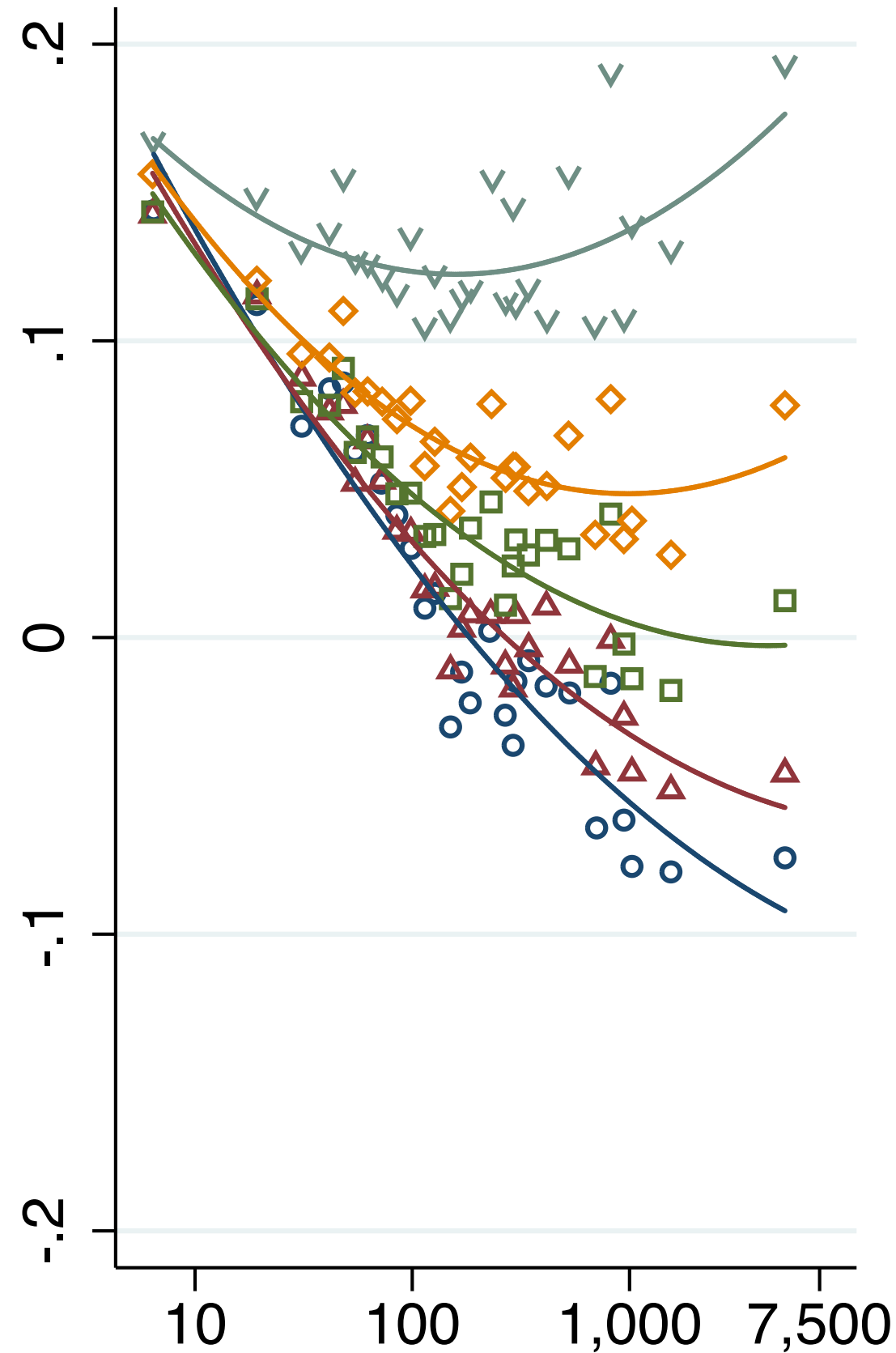
+ ○○

## Flattening Gradients

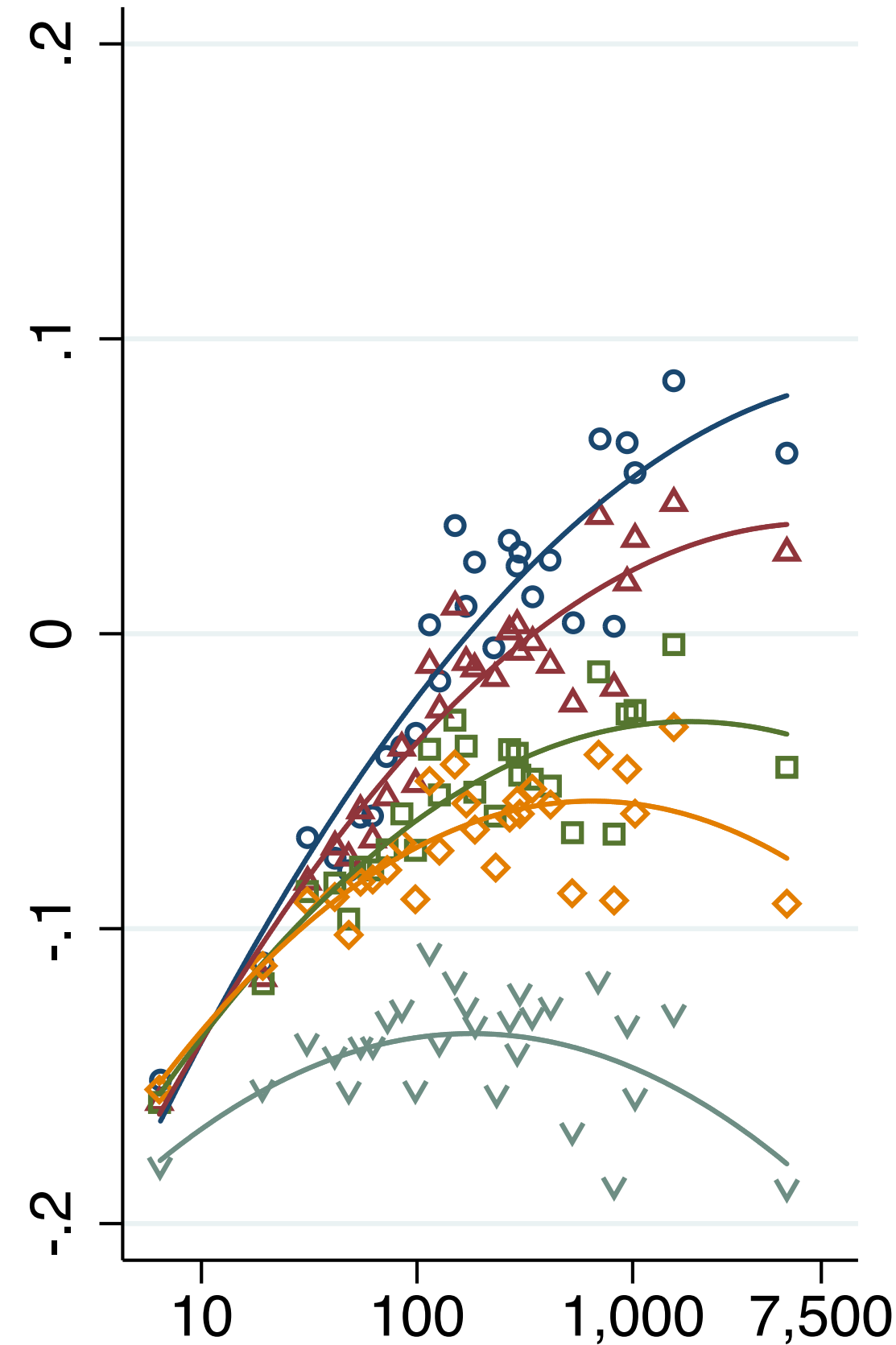
- Becomes **less positive** in mid-skill work
- Becomes **less negative** in low-skill work

# Occupation Shares among Non-College Adults: High School or Below (Level Relative to 1970 Mean)

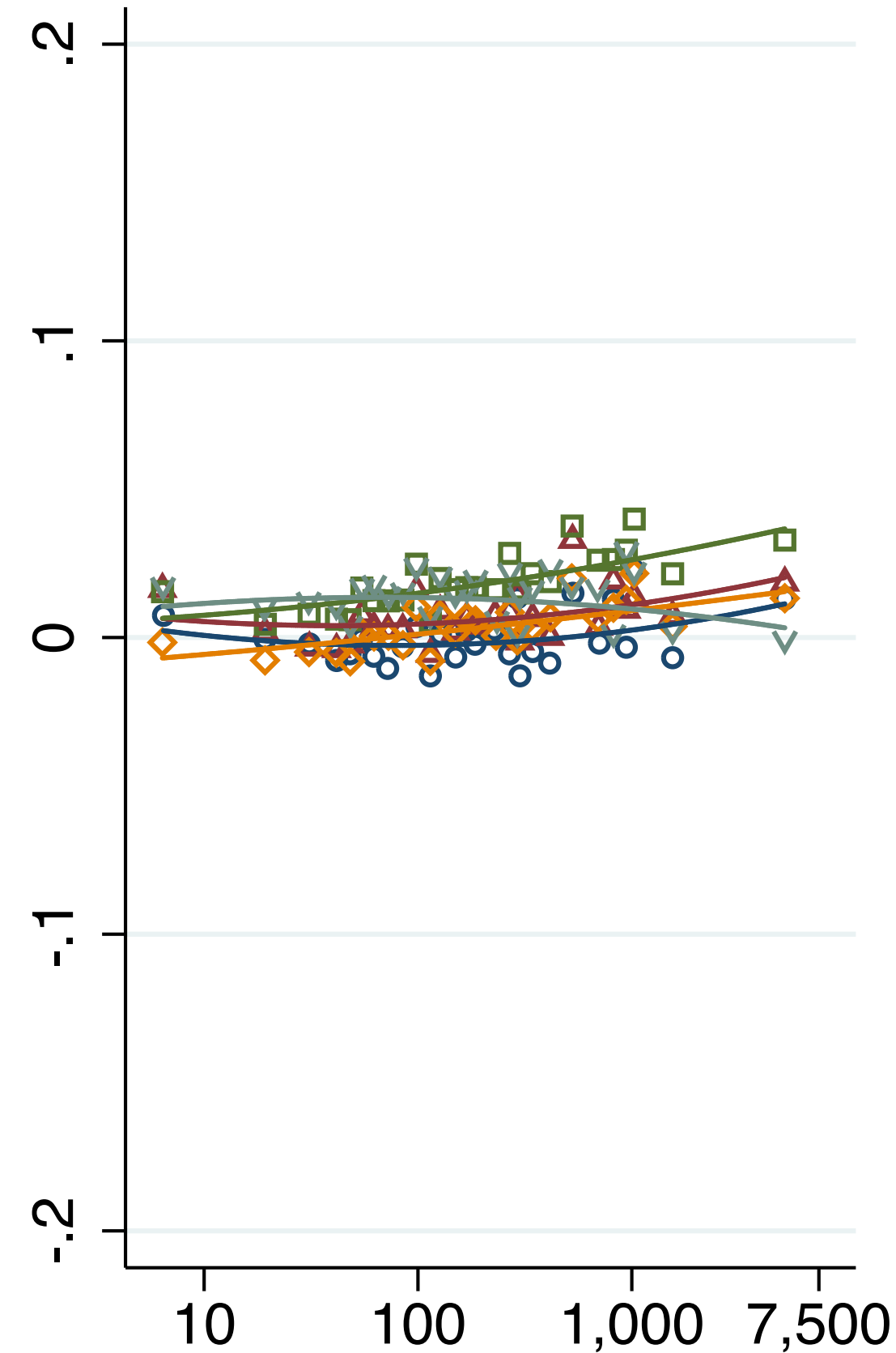
Low Skill: Services, Transport  
Construction, & Laborers



Mid Skill: Production, Clerical  
Administrative & Sales



High Skill: Professional  
Technical & Managerial



○ 1970    △ 1980    □ 1990    ◇ 2000    ▼ 2015

# Non-College Workers

1970 +  
80 + 90  
+ 00 + 15

**No Occupational Skill  
Gradient Remaining!**

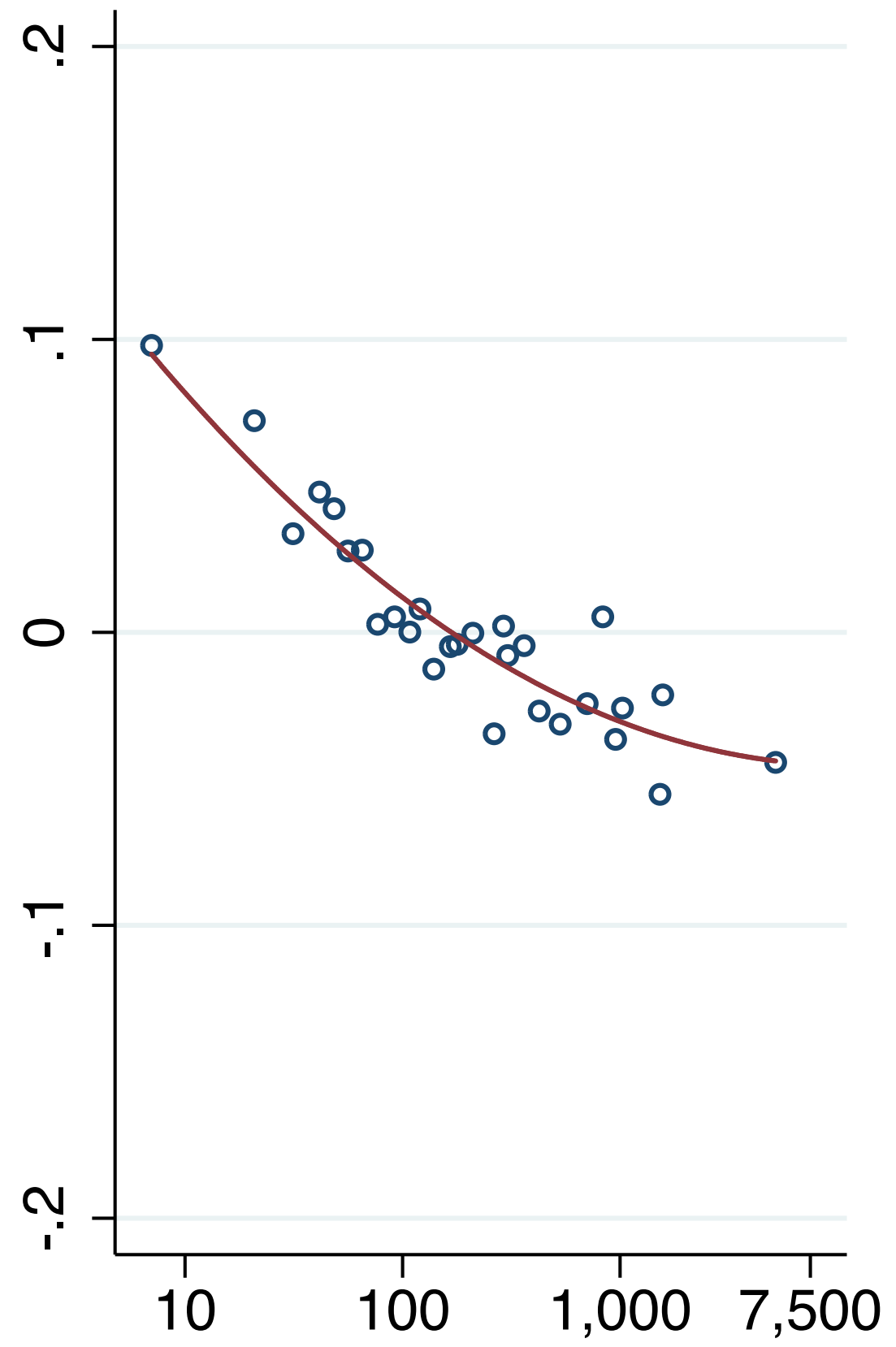
- Mid-skill work **as scarce** in cities as rural areas
- Low-skill work **as prevalent**

# College Workers 1970

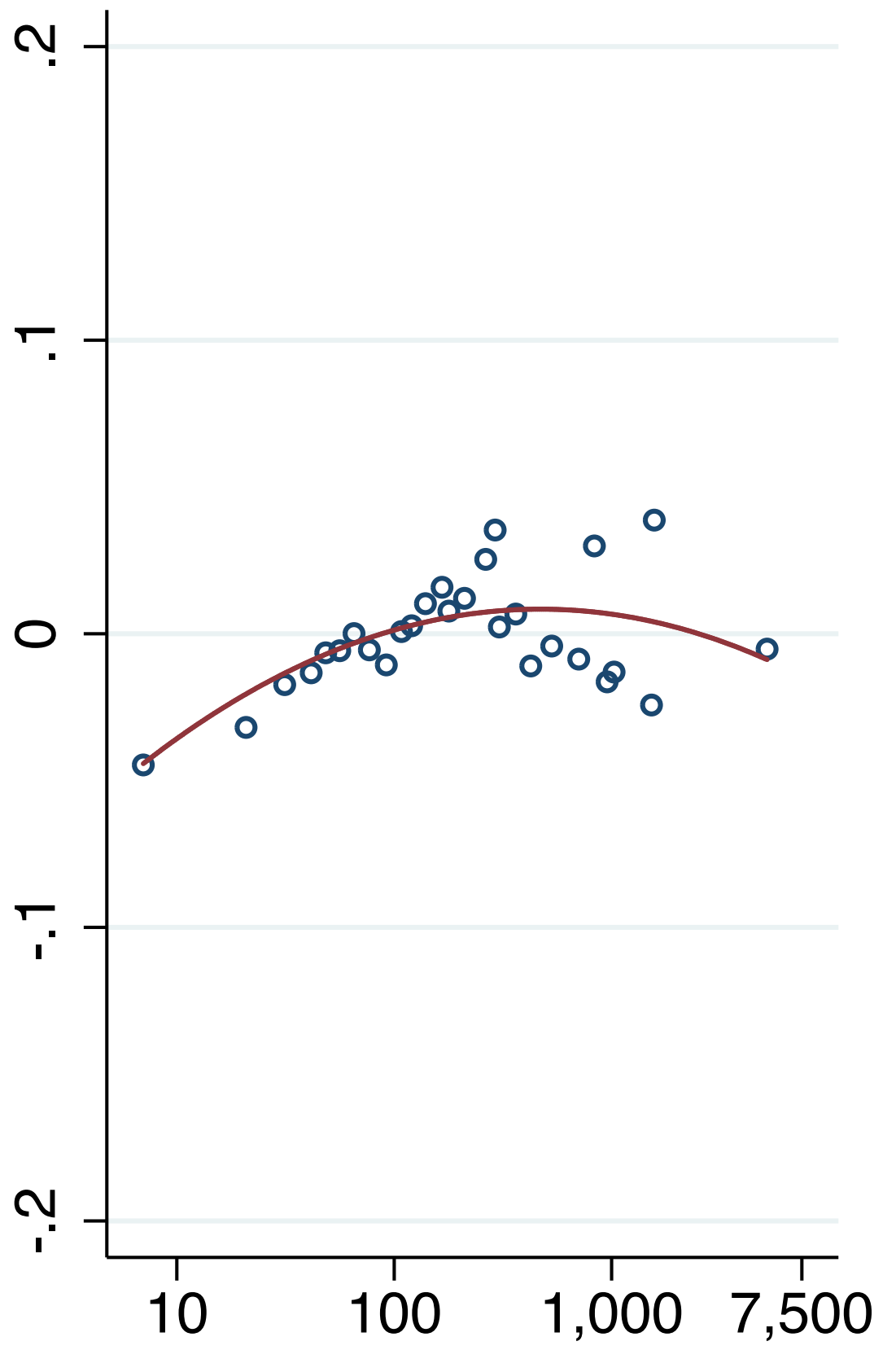
**Almost No Change  
in Occupational  
Distribution of  
College-Educated  
Adults**

## Occupation Shares among College Adults: Some-College or Above (Level Relative to 1970 Mean)

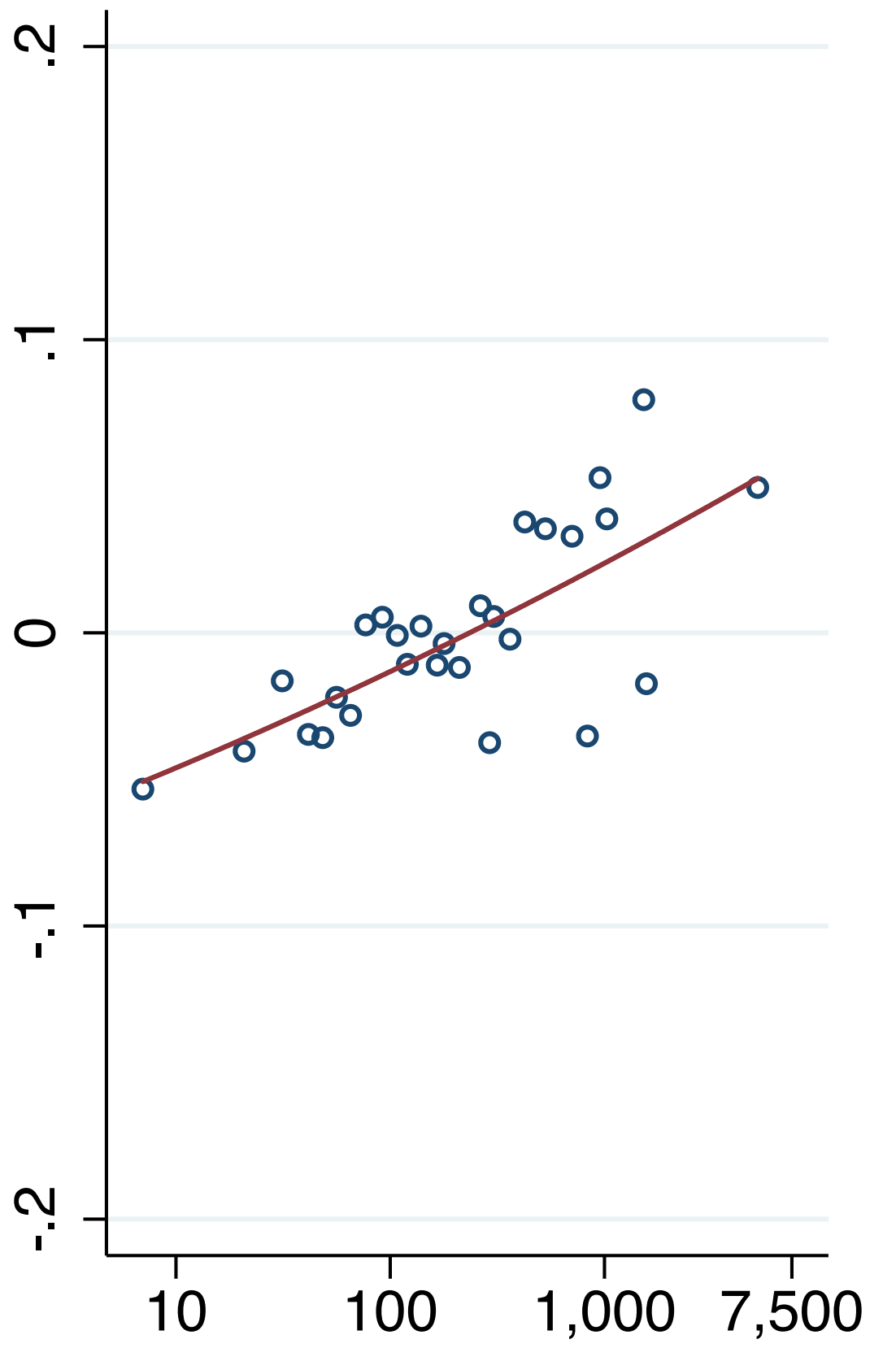
Low Skill: Services, Transport  
Construction, & Laborers



Mid Skill: Production, Clerical  
Administrative & Sales



High Skill: Professional  
Technical & Managerial

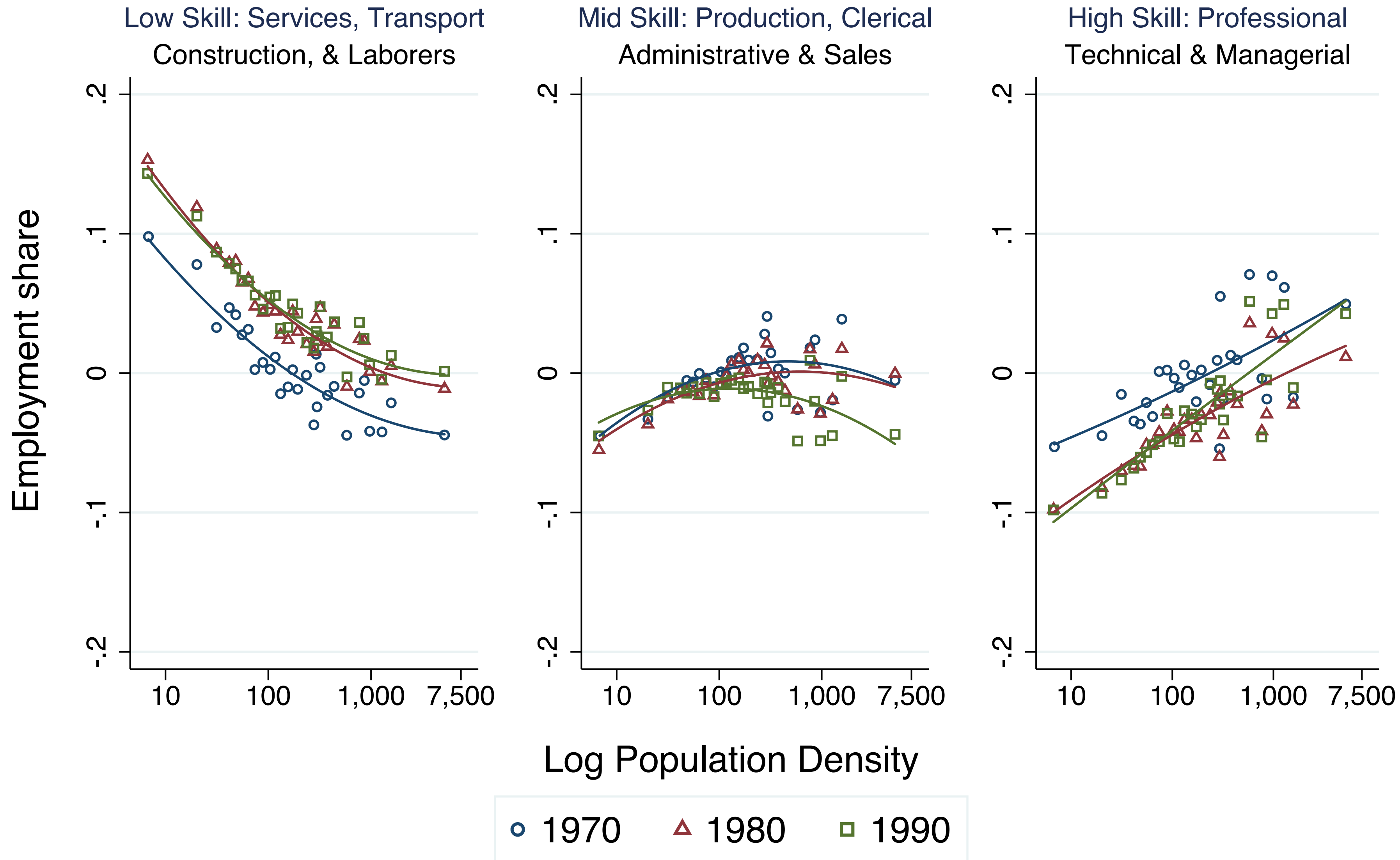


Log Population Density

○ 1970



# Occupation Shares among College Adults: Some-College or Above (Level Relative to 1970 Mean)



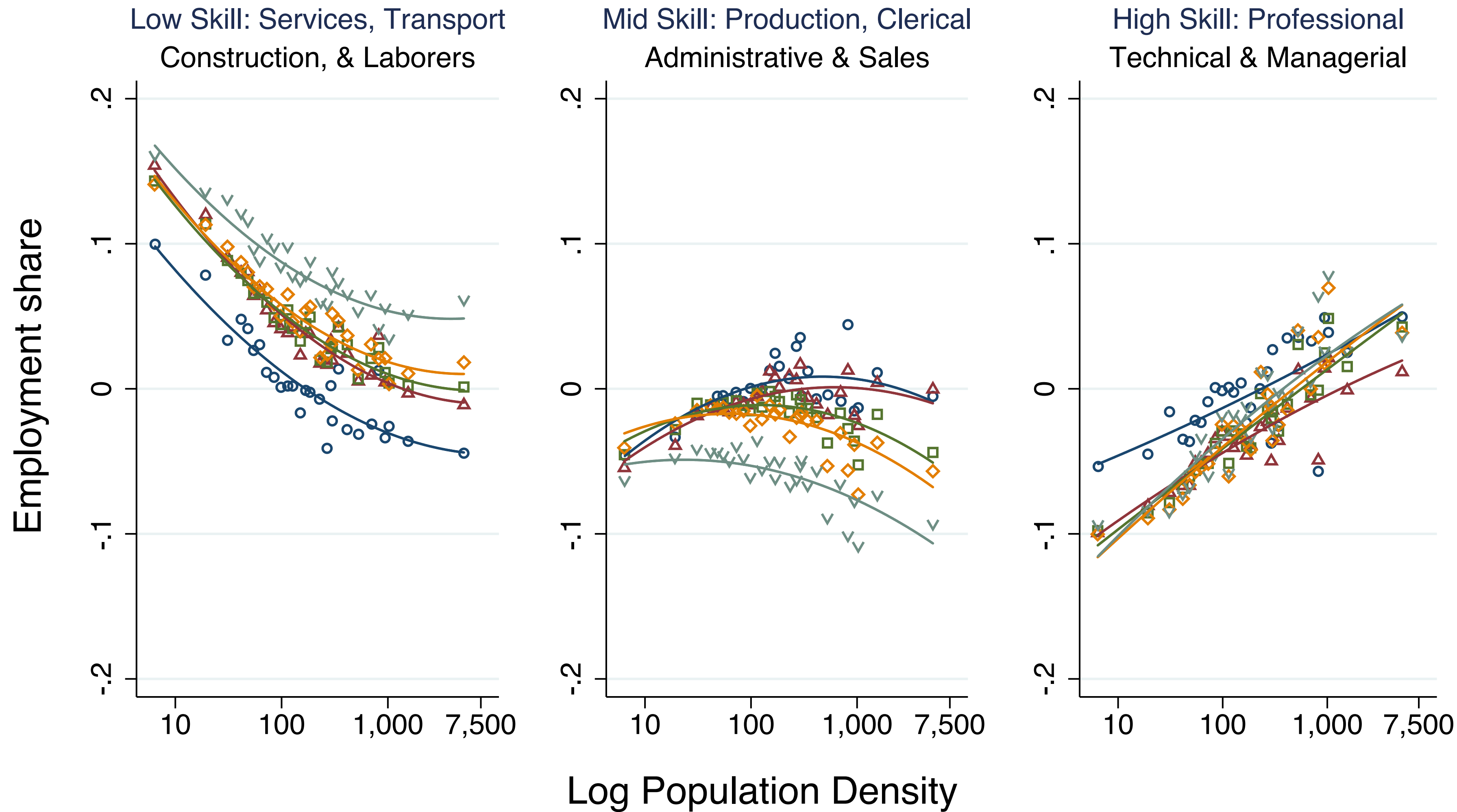
College  
Workers

1970 +

80 + 90

**Mid and High Skill  
Work Rising in  
Population Density**

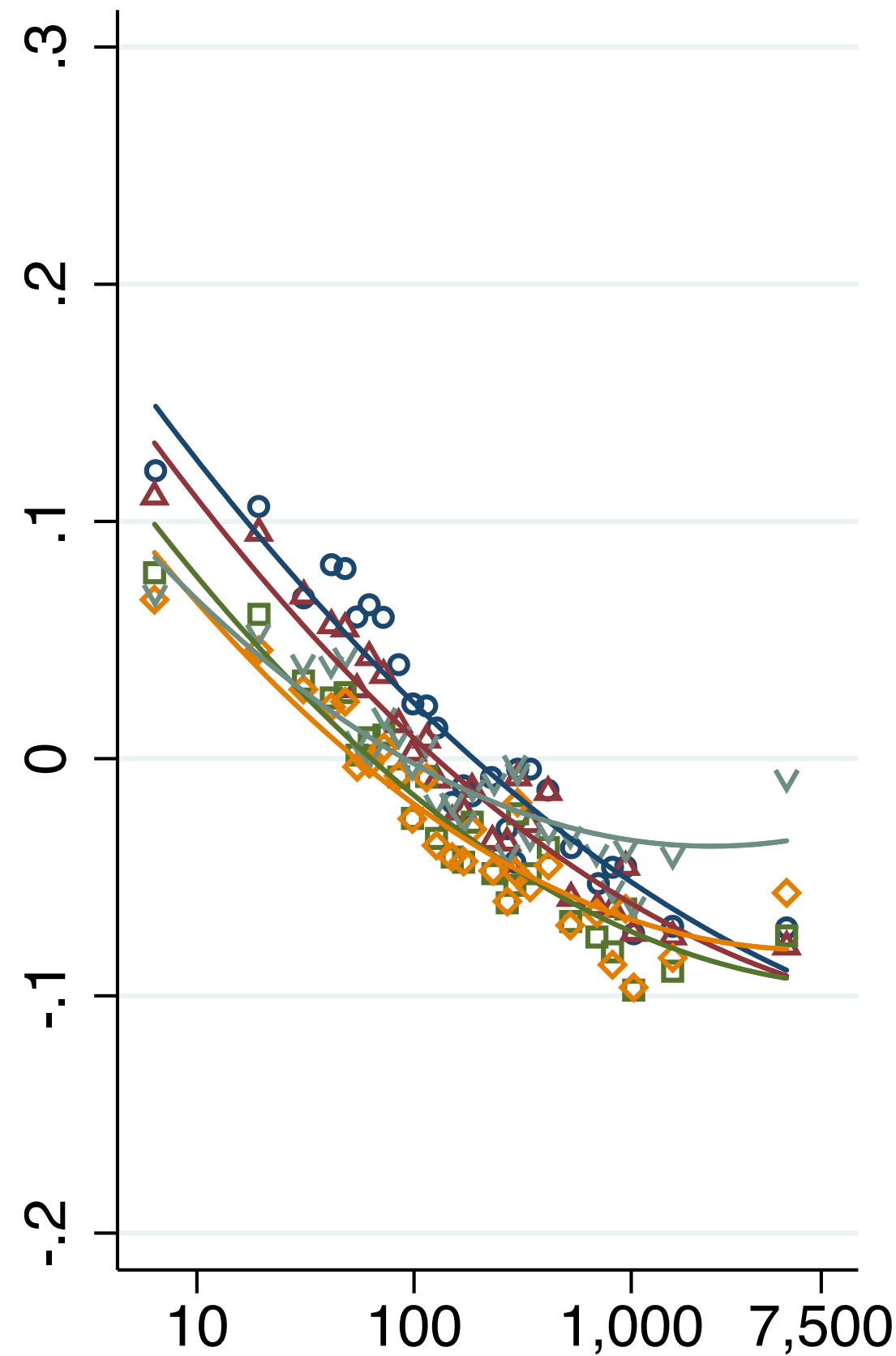
# Occupation Shares among College Adults: Some-College or Above (Level Relative to 1970 Mean)



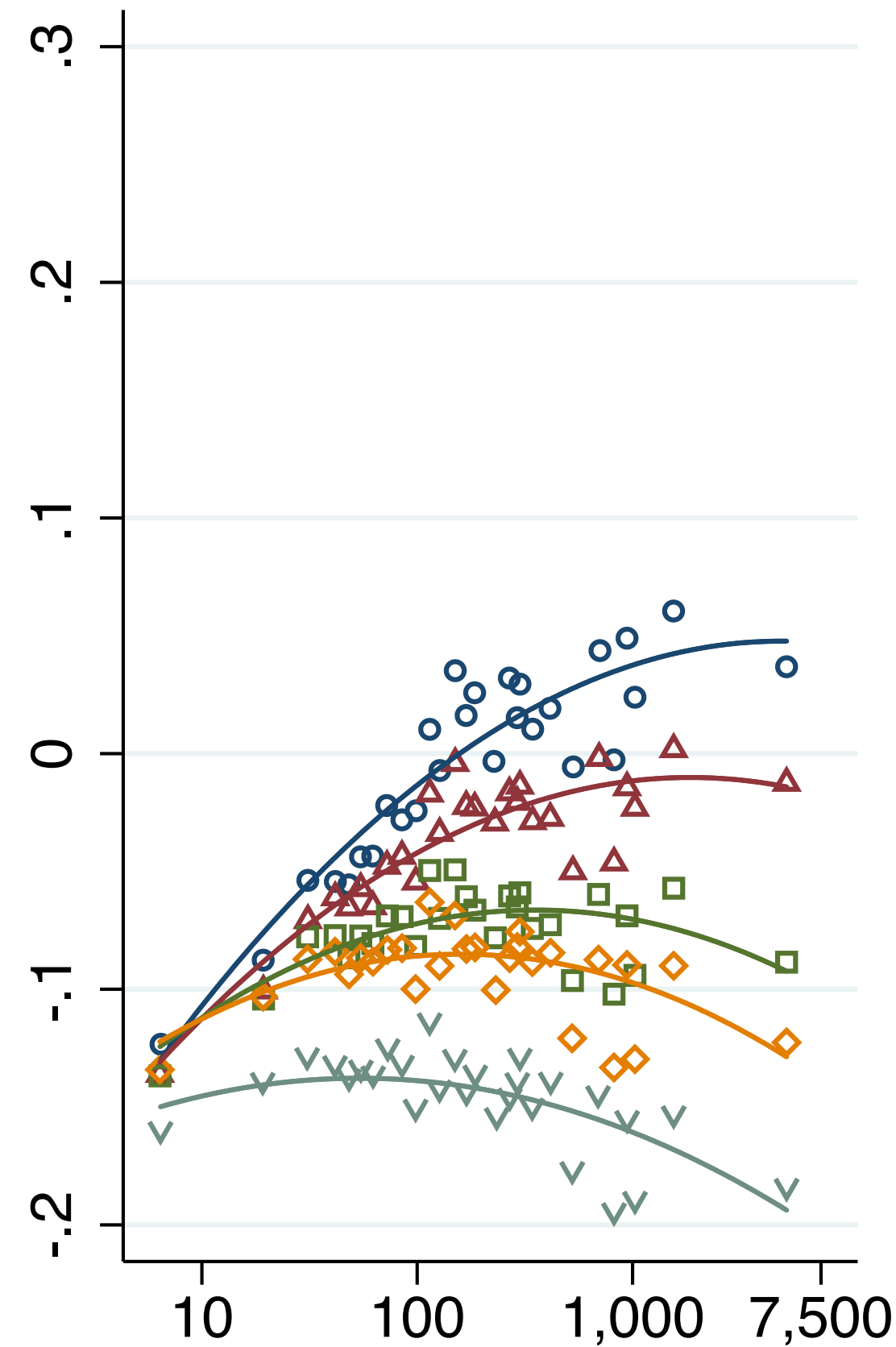
College  
Workers  
1970 +  
80 + 90  
+ 00 + 15  
Little change in  
occupational  
distribution of  
college-educated  
workers

# Occupation Shares among Working Age Adults (Level Relative to 1970 Mean)

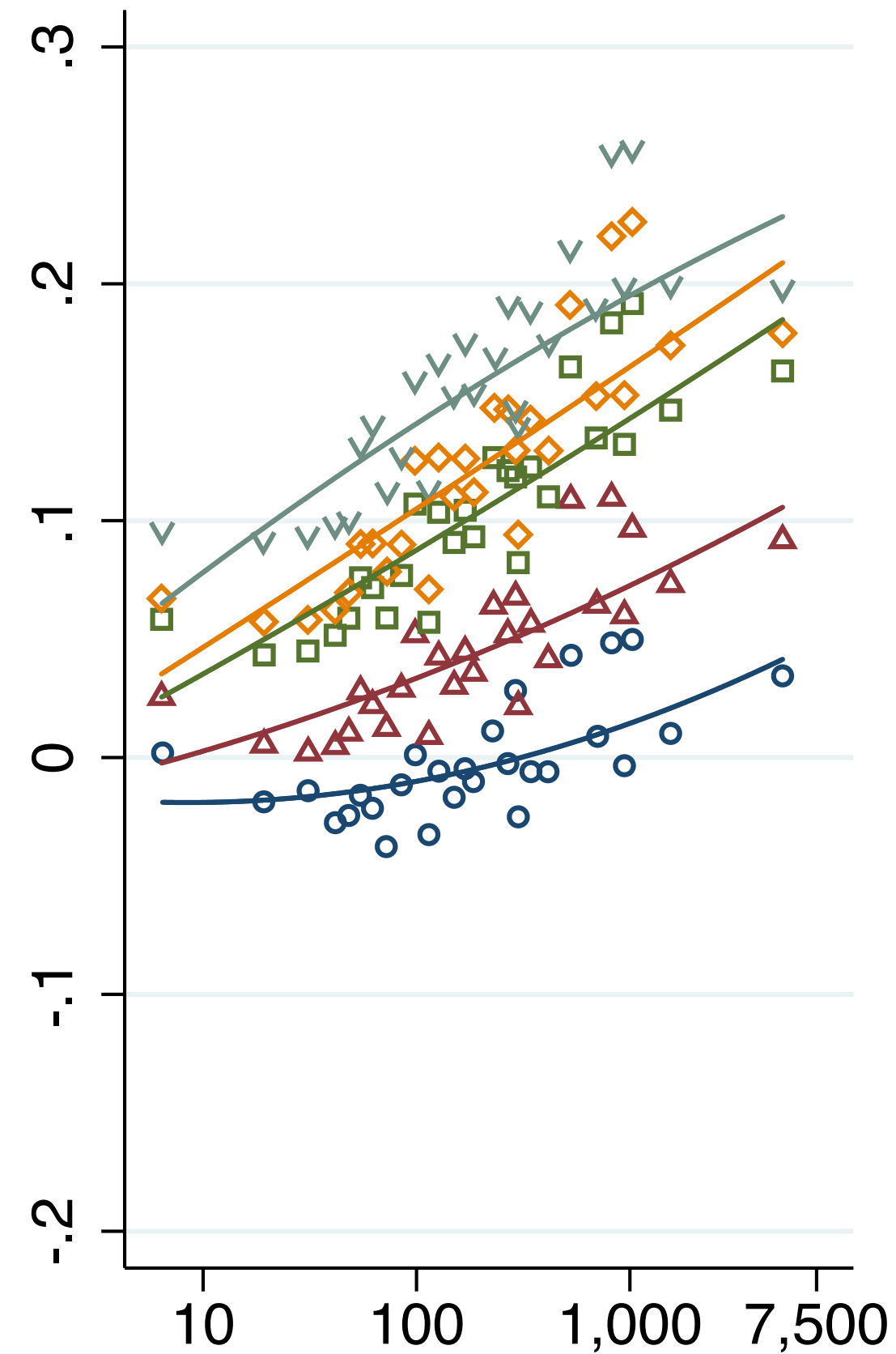
Low Skill: Services, Transport  
Construction, & Laborers



Mid Skill: Production, Clerical  
Administrative & Sales



High Skill: Professional  
Technical & Managerial



○ 1970    △ 1980    □ 1990    ◇ 2000    ▽ 2015

All Workers

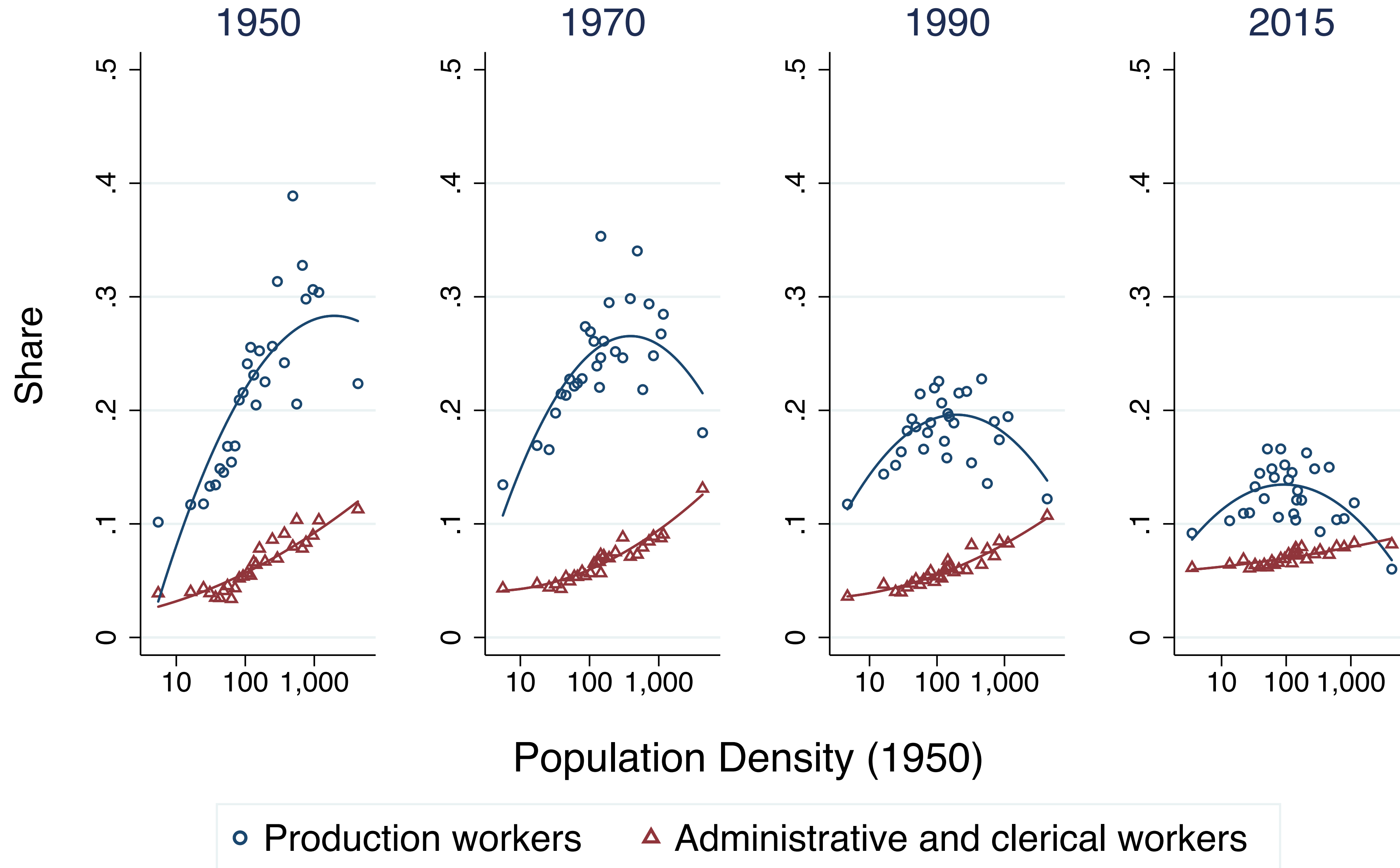
1970 +

80 + 90

+ 00 + 15

There is Now Less  
Middle-Skill Work in  
Cities than in Metro  
and Rural Areas

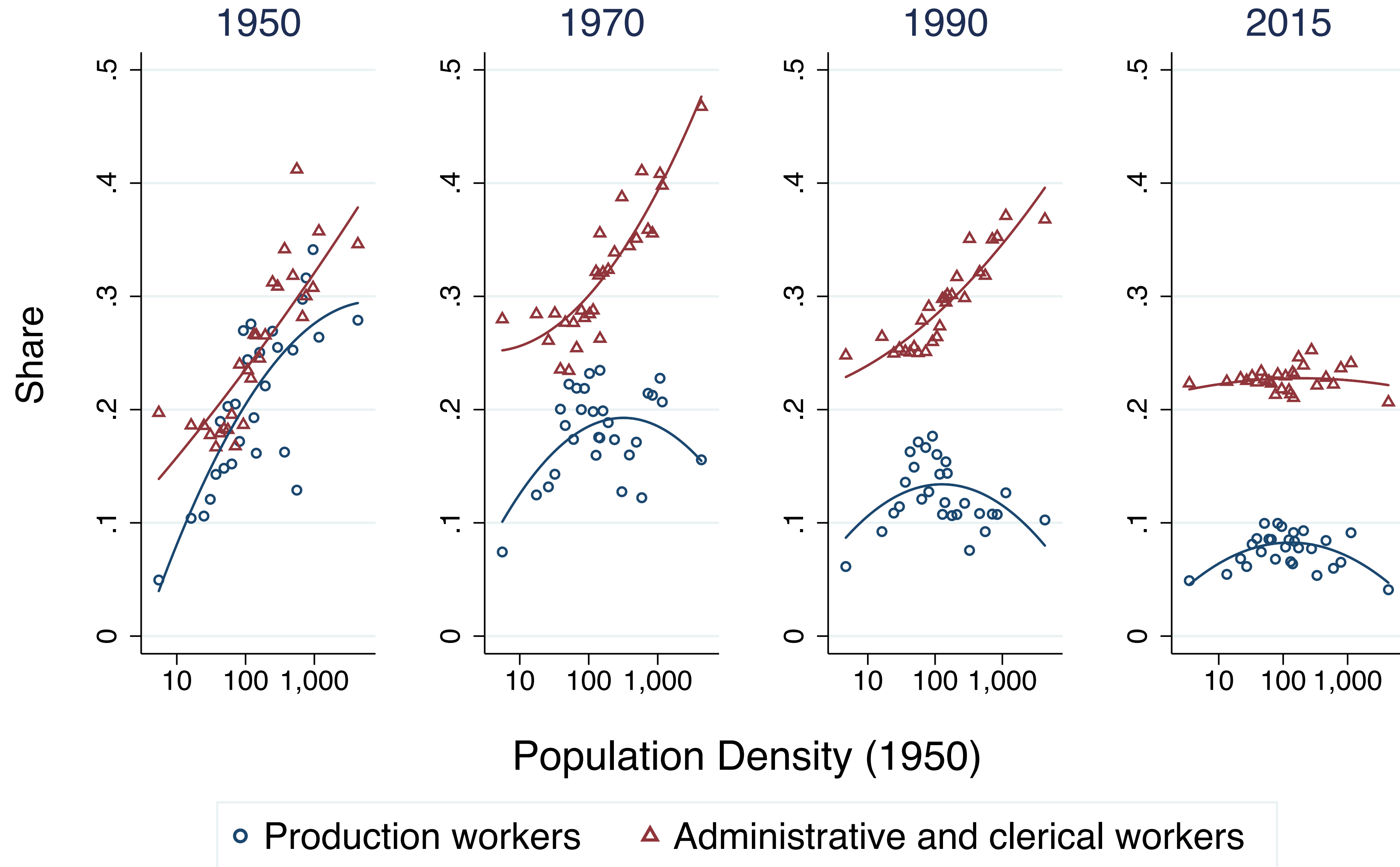
# Production and Administrative and Clerical Employment Non-College Men: High School or Below



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

**Production Jobs**  
**~30% of Jobs to <10%**  
**of Urban Jobs**  
**between**  
**1950 and 2015**

# Production and Administrative and Clerical Employment Non-College Women: High School or Below



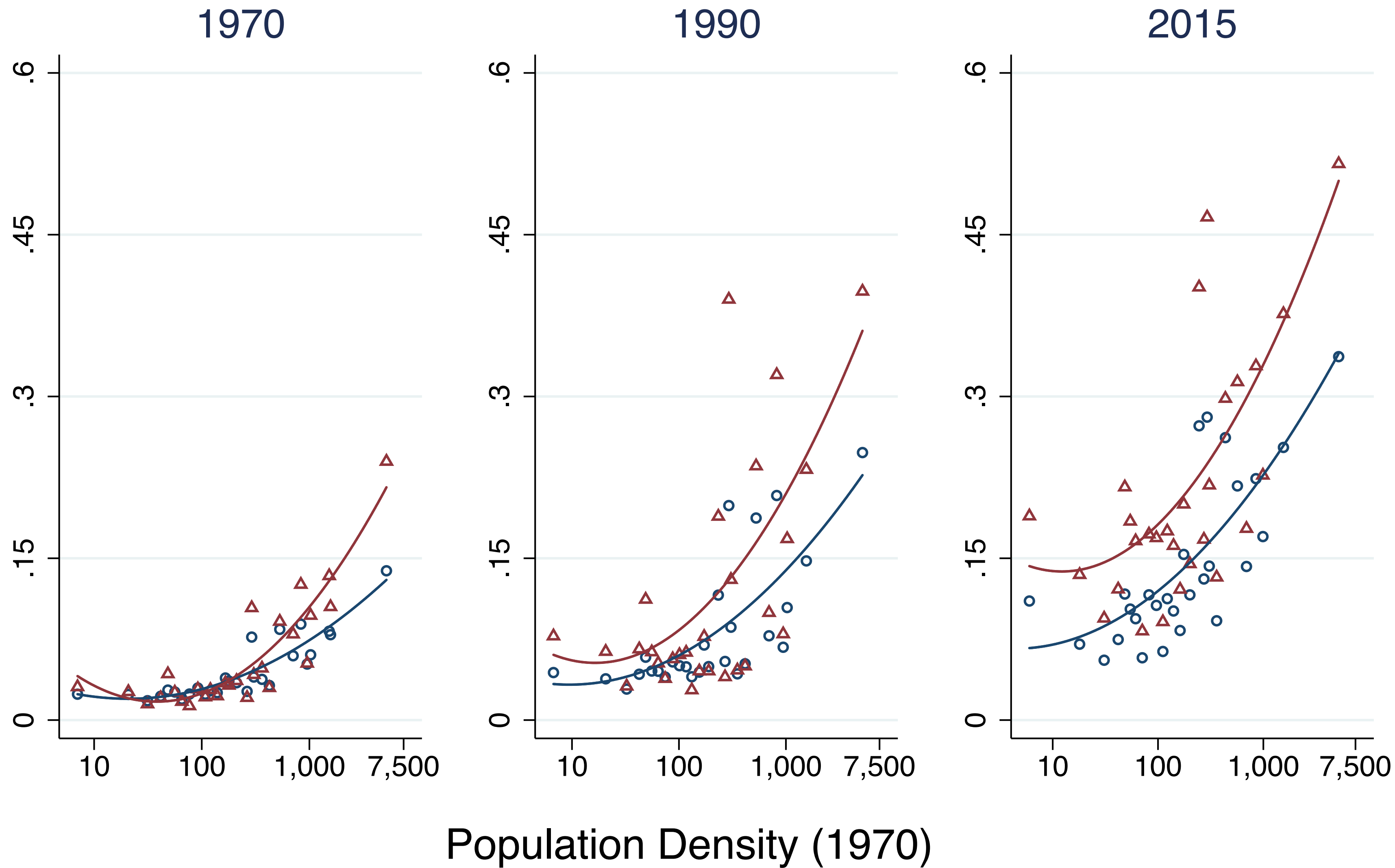
Where Did the  
Middle Skill,  
Urban Jobs Go?  
Non-College  
Women

**Administrative +  
Clerical Jobs Fall  
from ~50% of Jobs  
to ~20% of Jobs  
between  
1970 and 2015**

# Foreign Born Shares of College and Non-College Working Age Adults

## What about the Role of Foreign Born Workers?

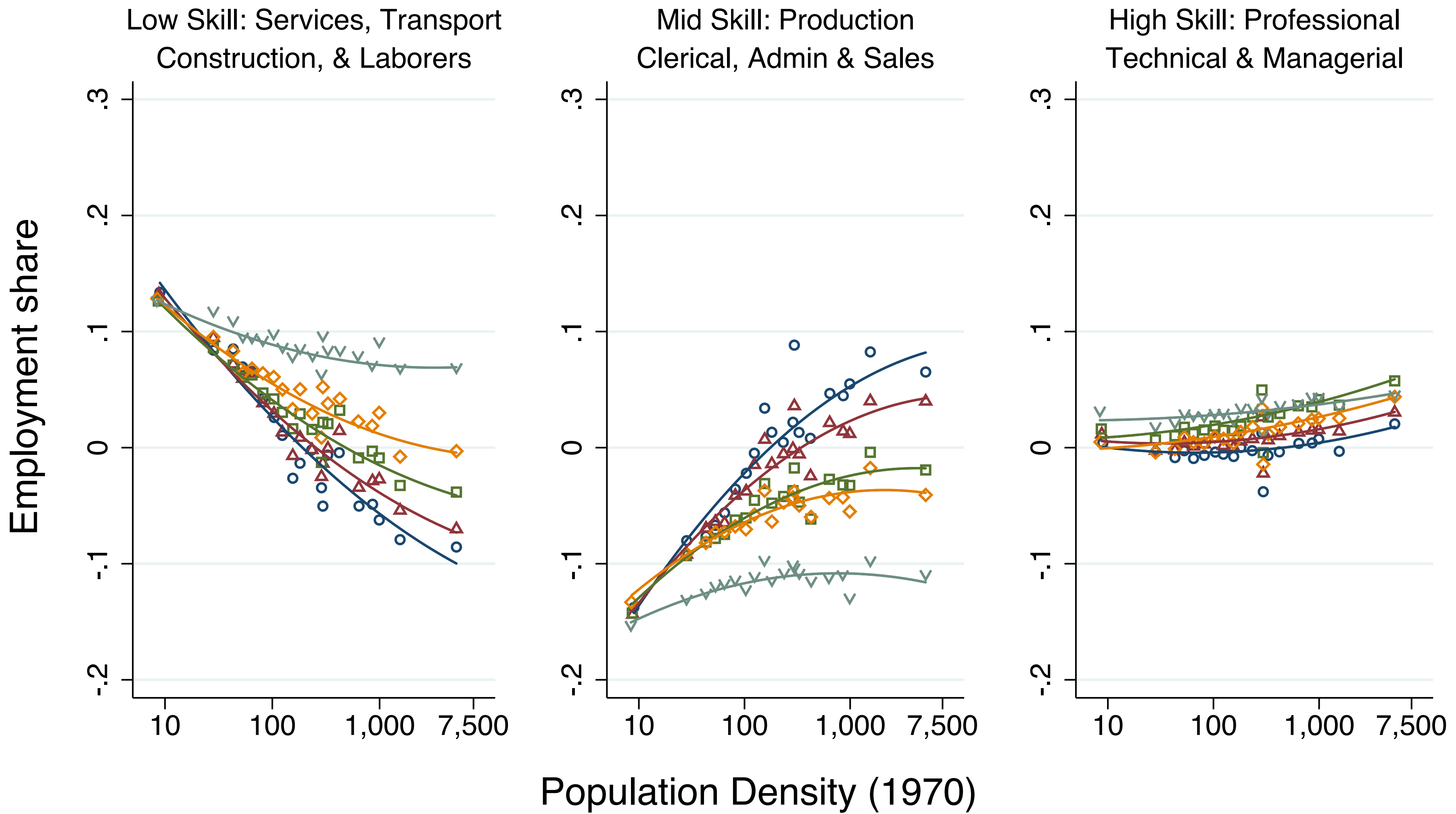
- They make up a disproportionate fraction of urban college and non-college workers
- Fraction is rising steeply over decades



○ Foreign-born share of college    △ Foreign-born share of non-college

# Occupation Shares among US Born Non-College Men and Women (Level Relative to 1970 Mean)

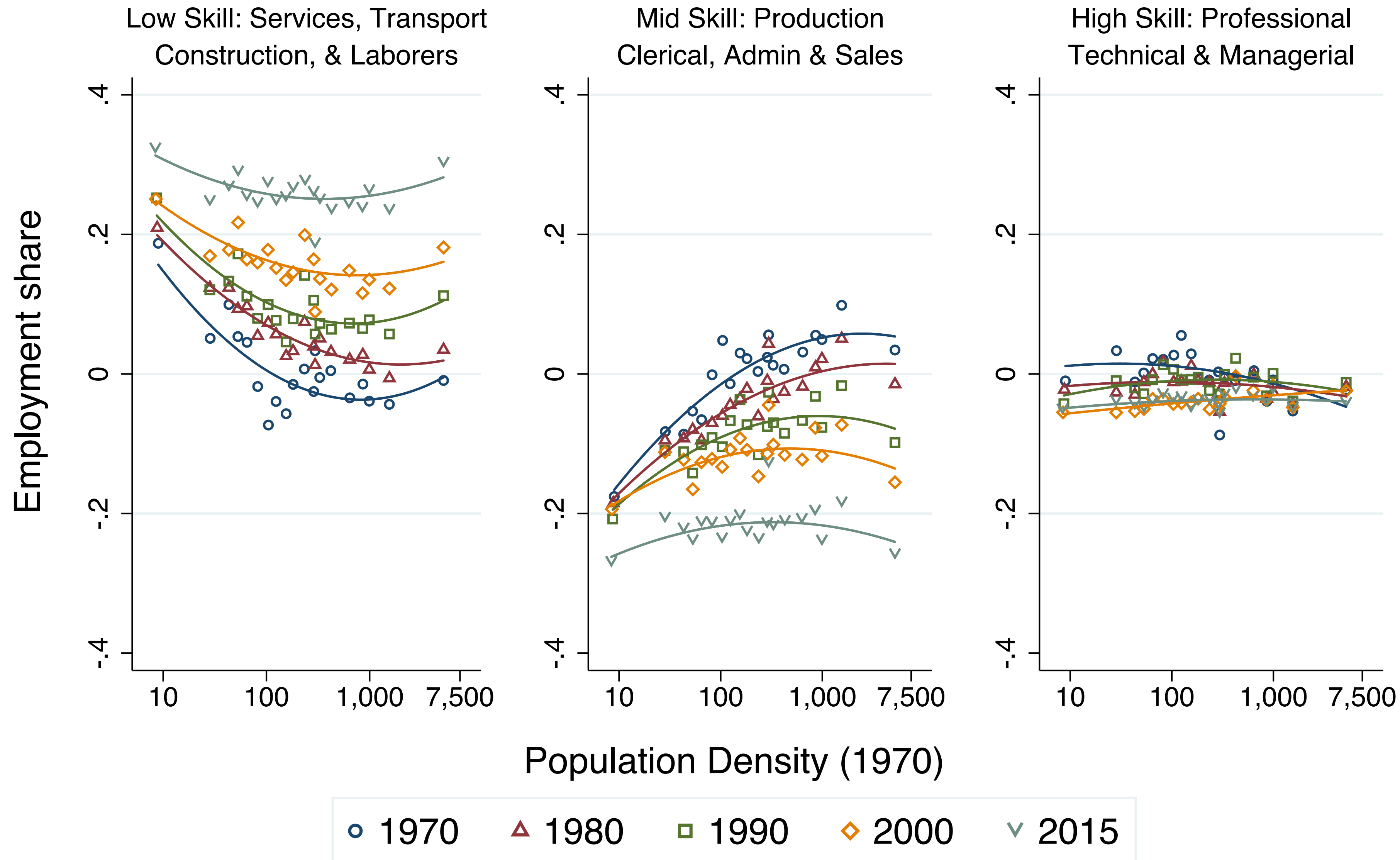
# U.S. Born Non-College Workers



○ 1970    △ 1980    □ 1990    ◇ 2000    ▼ 2015

# Occupation Shares among Foreign-Born Non-College Men and Women (Level Relative to 1970 Mean)

# Foreign Born Non-College Workers

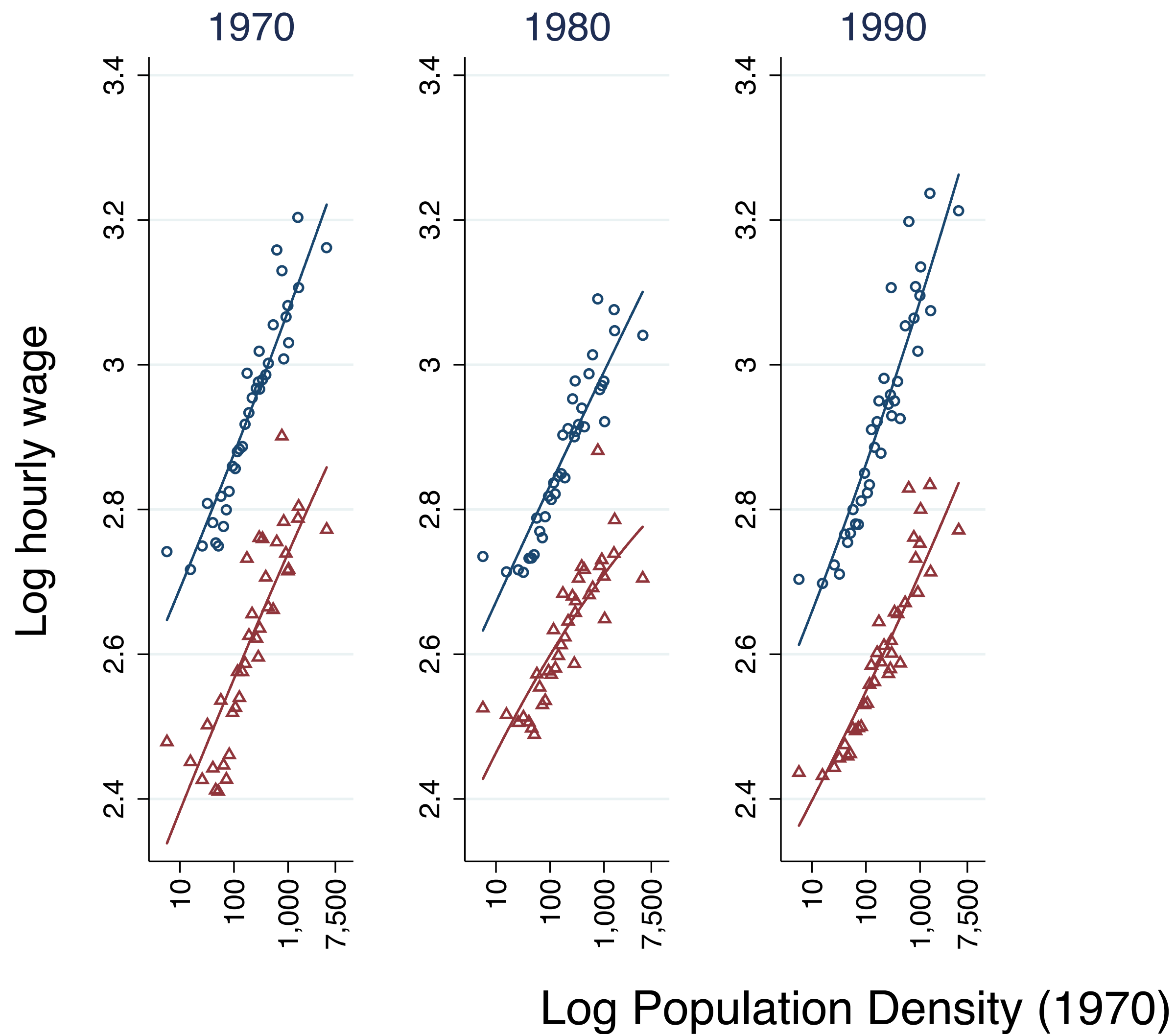




II.

The Changing Geography  
of Wages

# Real Log College and Non-College Hourly Earnings (\$2015) Working-Age Adults

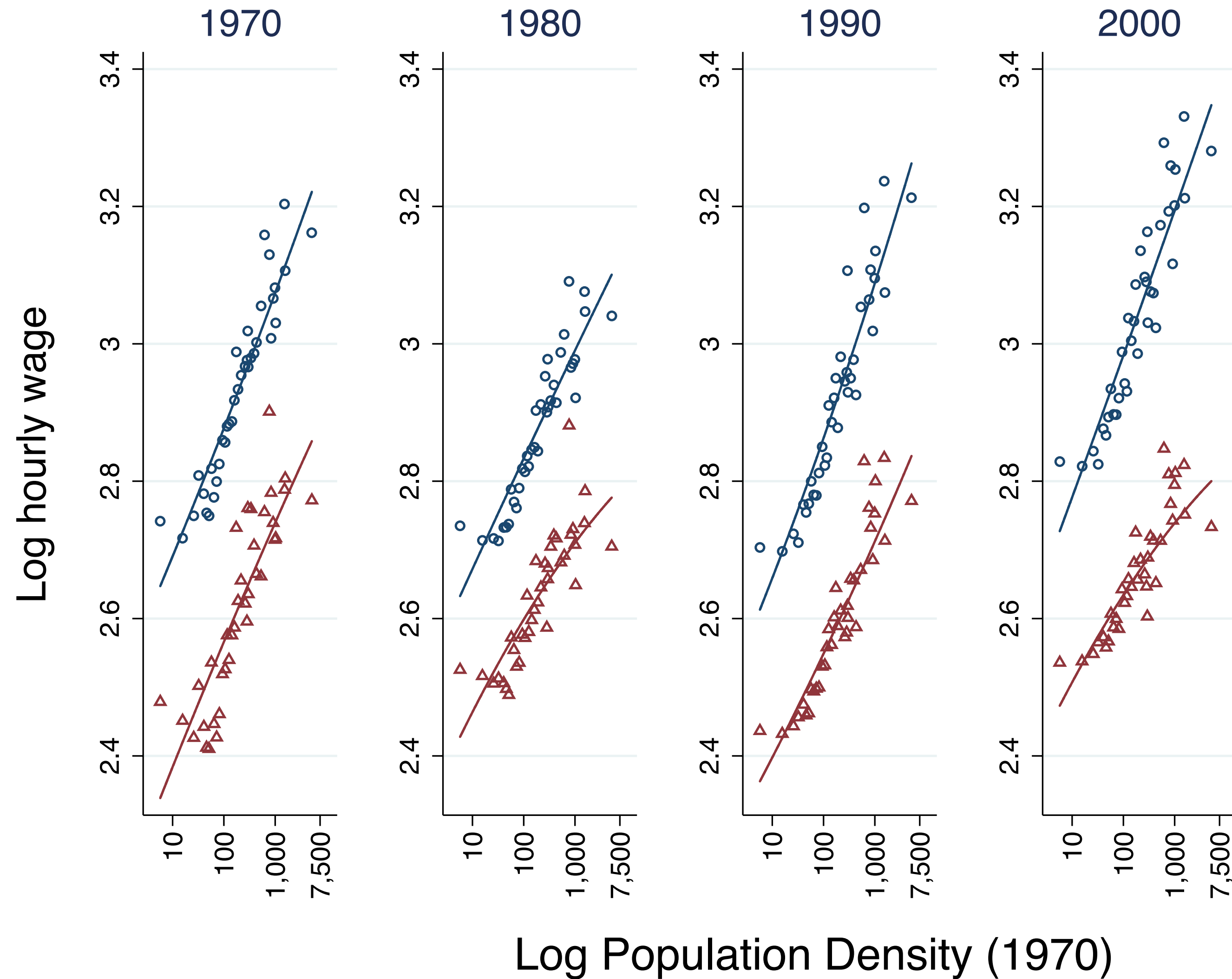


○ Some College or Greater    △ High School or Less

## 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

# Real Log College and Non-College Hourly Earnings (\$2015) Working-Age Adults

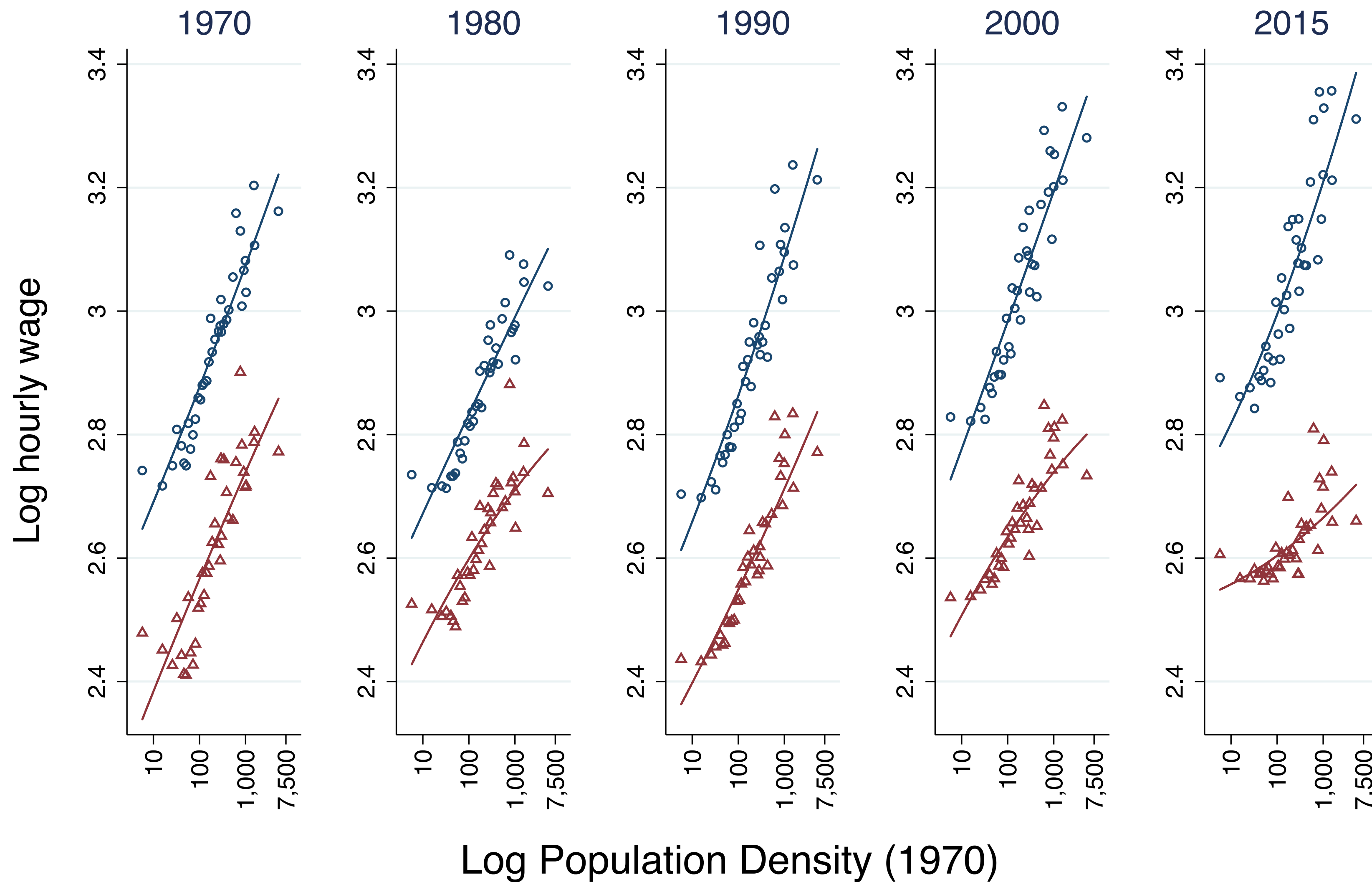


○ Some College or Greater    △ High School or Less

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

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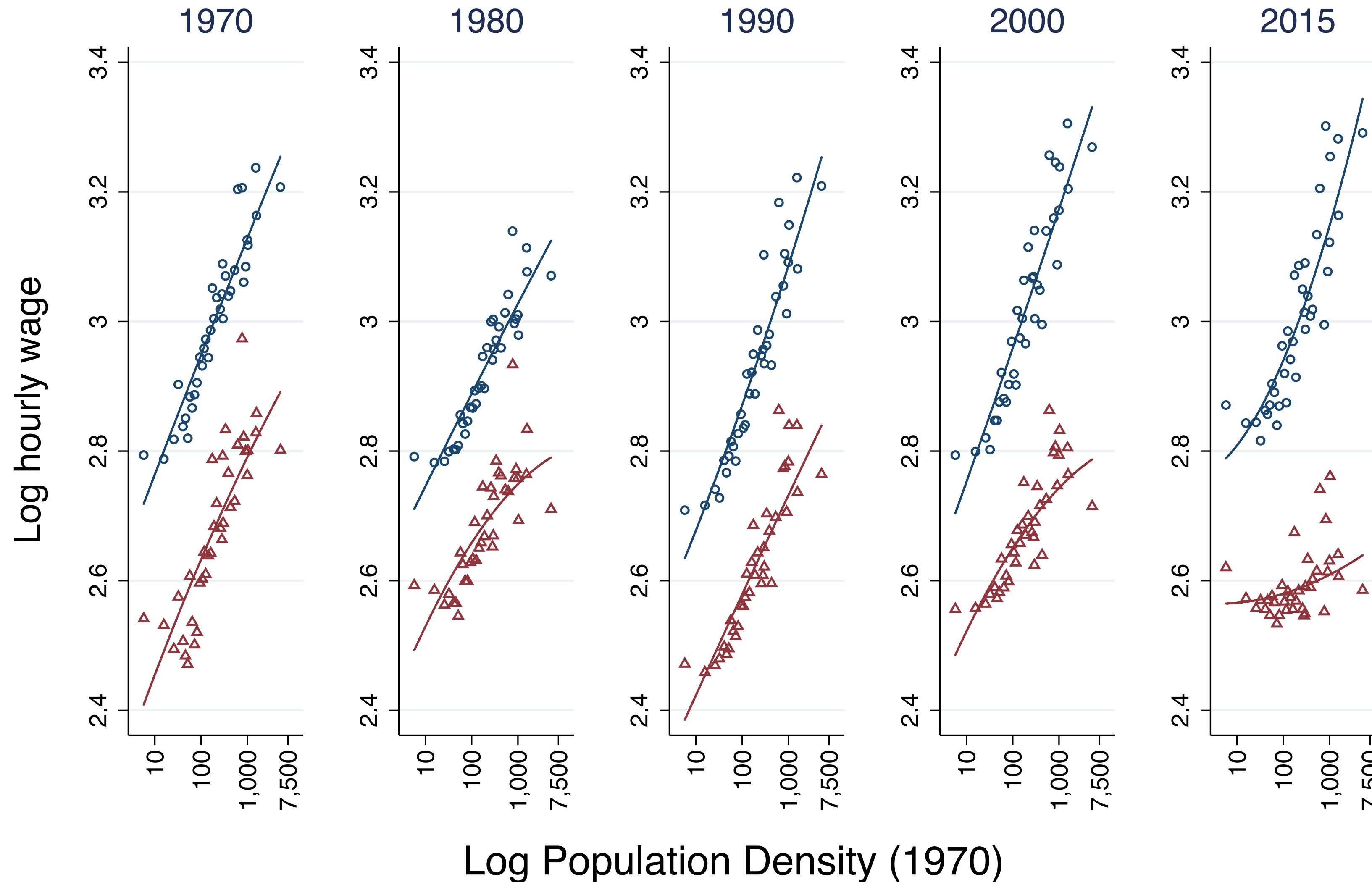


○ Some College or Greater    △ High School or Less

## 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

# Real Log College and Non-College Hourly Earnings (\$2015) Men and Women, Ages 25 - 39

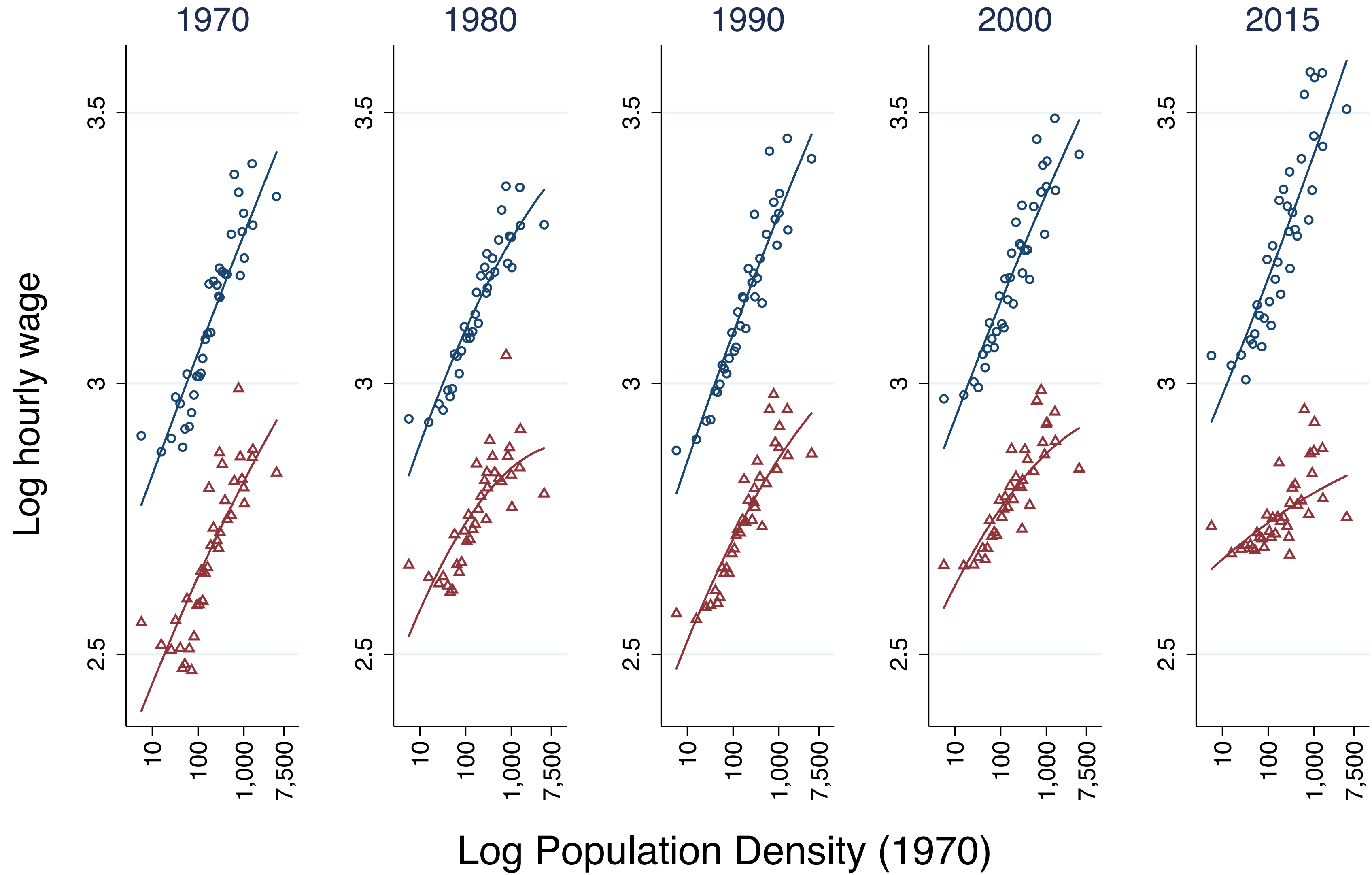


○ Some College or Greater    ▲ High School or Less

## 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

# Real Log College and Non-College Hourly Earnings (\$2015) Men and Women, Ages 40 - 54

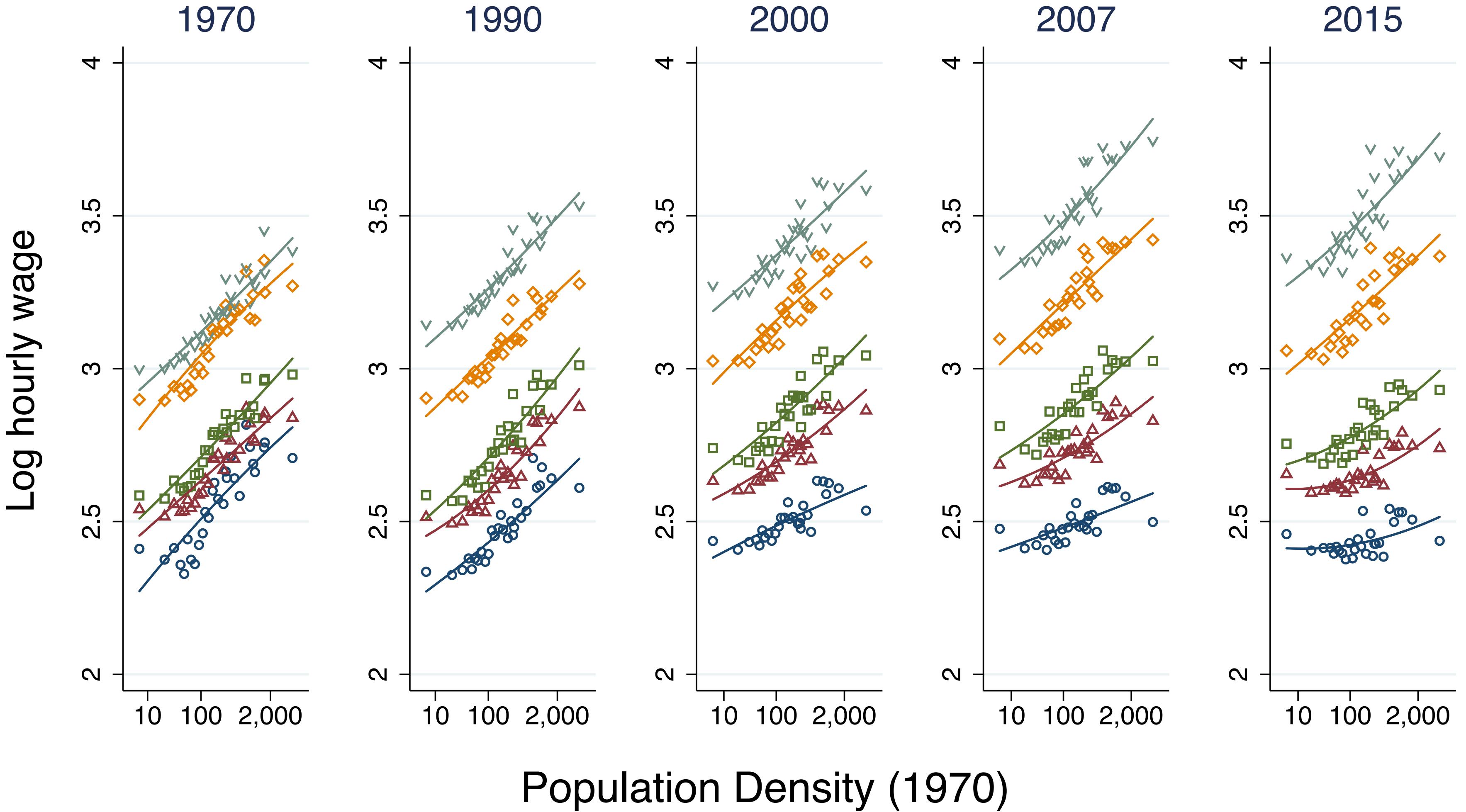


○ Some College or Greater    ▲ High School or Less

## 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

# Log Real Hourly Earnings by Education Level (\$2015) Working-Age Adults



○ Less than HS    ▲ HS grad    □ Some college    ◇ College degree    ▼ Post-college

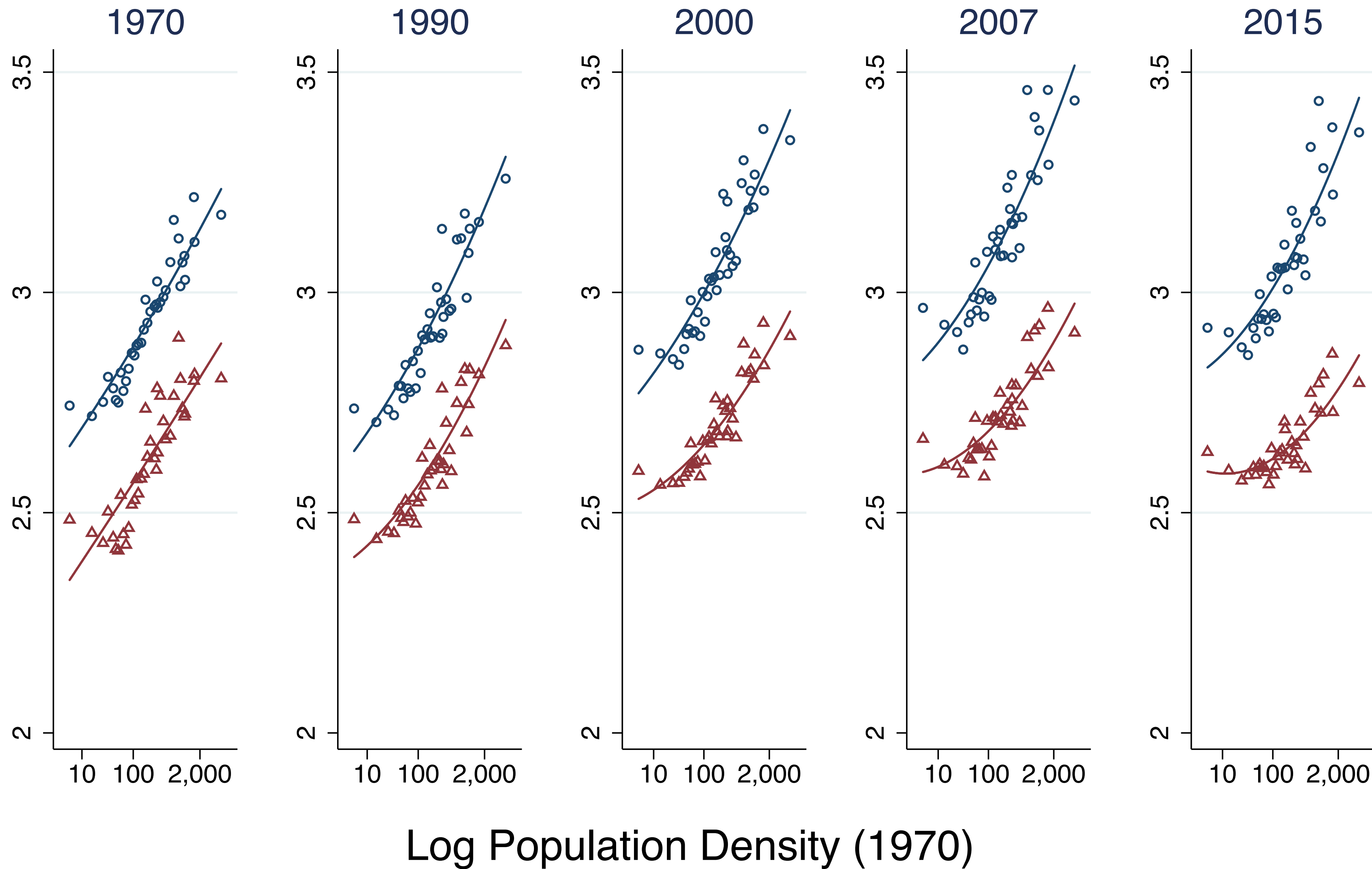
## Five Distinct Education Groups

- Fall in the Urban Wage premium for non-college workers
- Visible among high school dropout, high school graduate, and some-college workers

# Log Real Earnings of US Born Working-Age Adults (\$2015)

## Wages of U.S.-Born Workers

- U.S.-Born College Educated
- U.S.-Born Non-College Educated



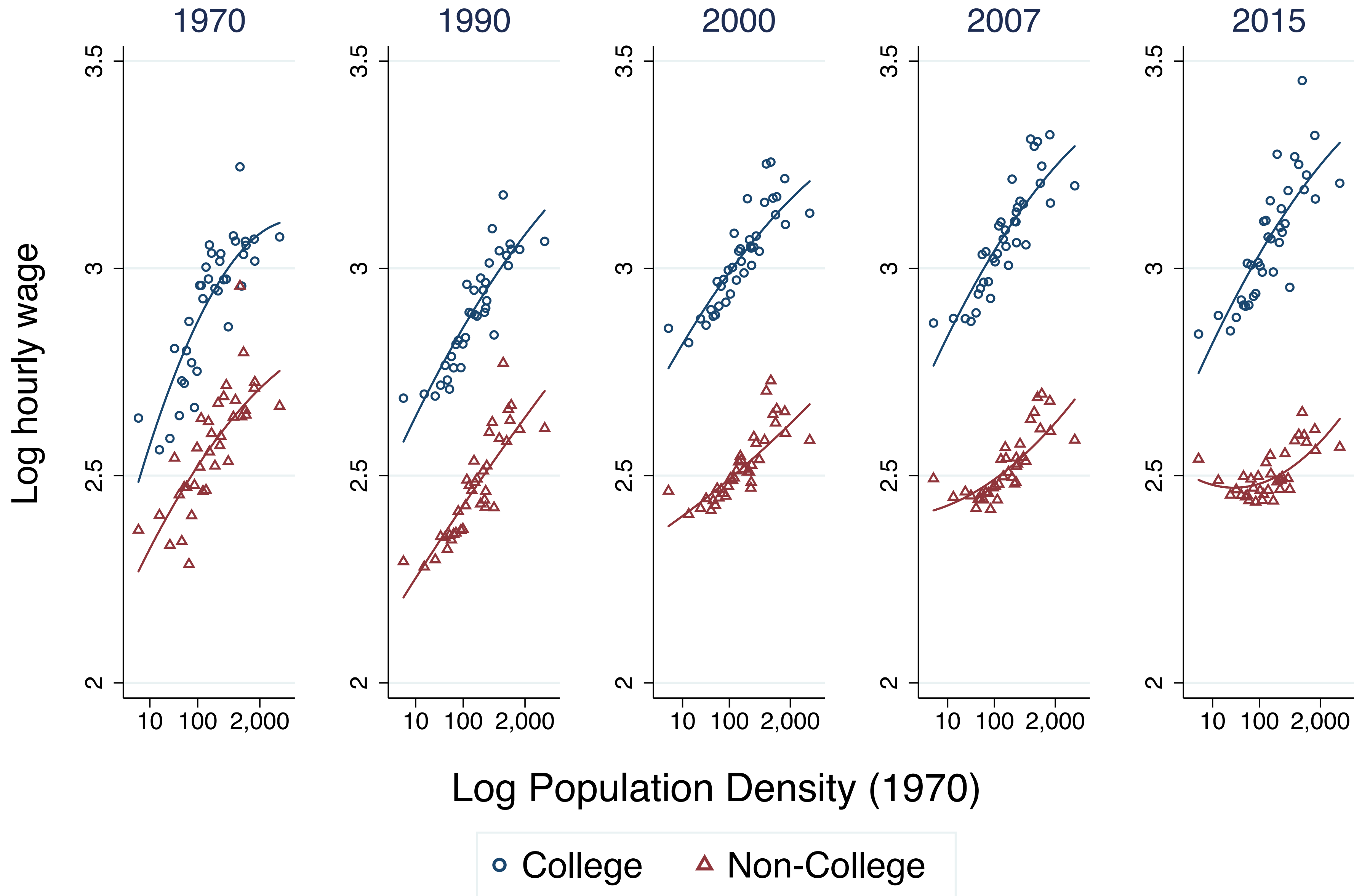
○ College    △ Non-College



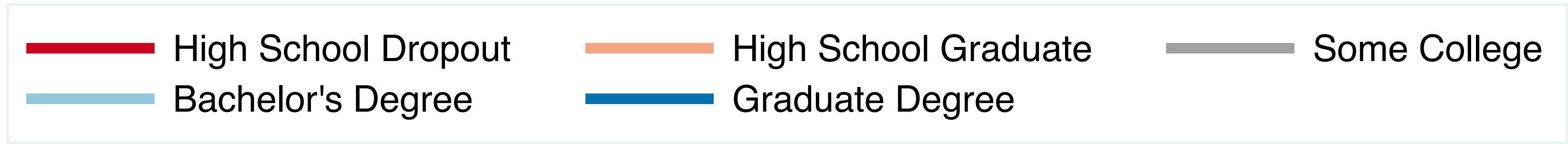
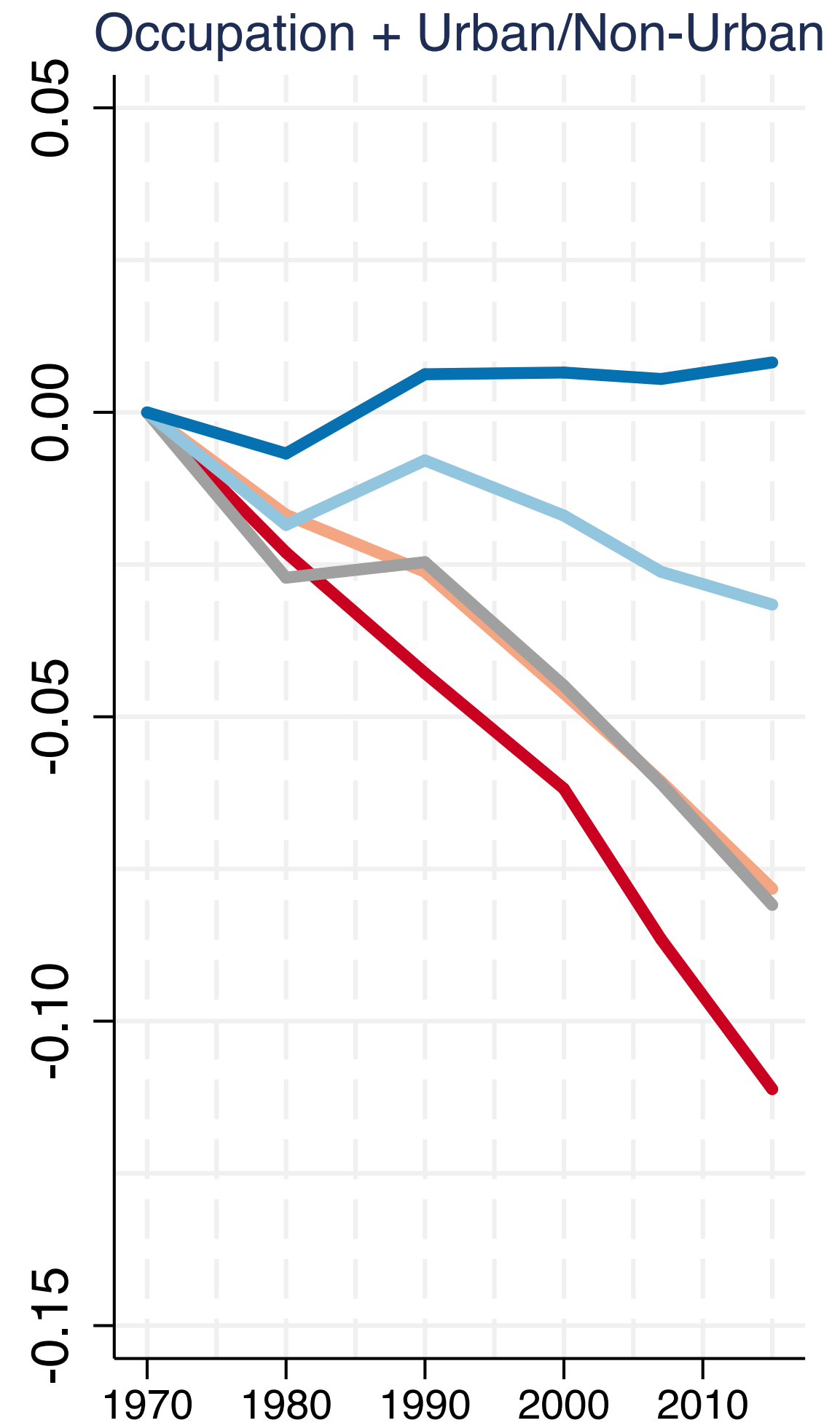
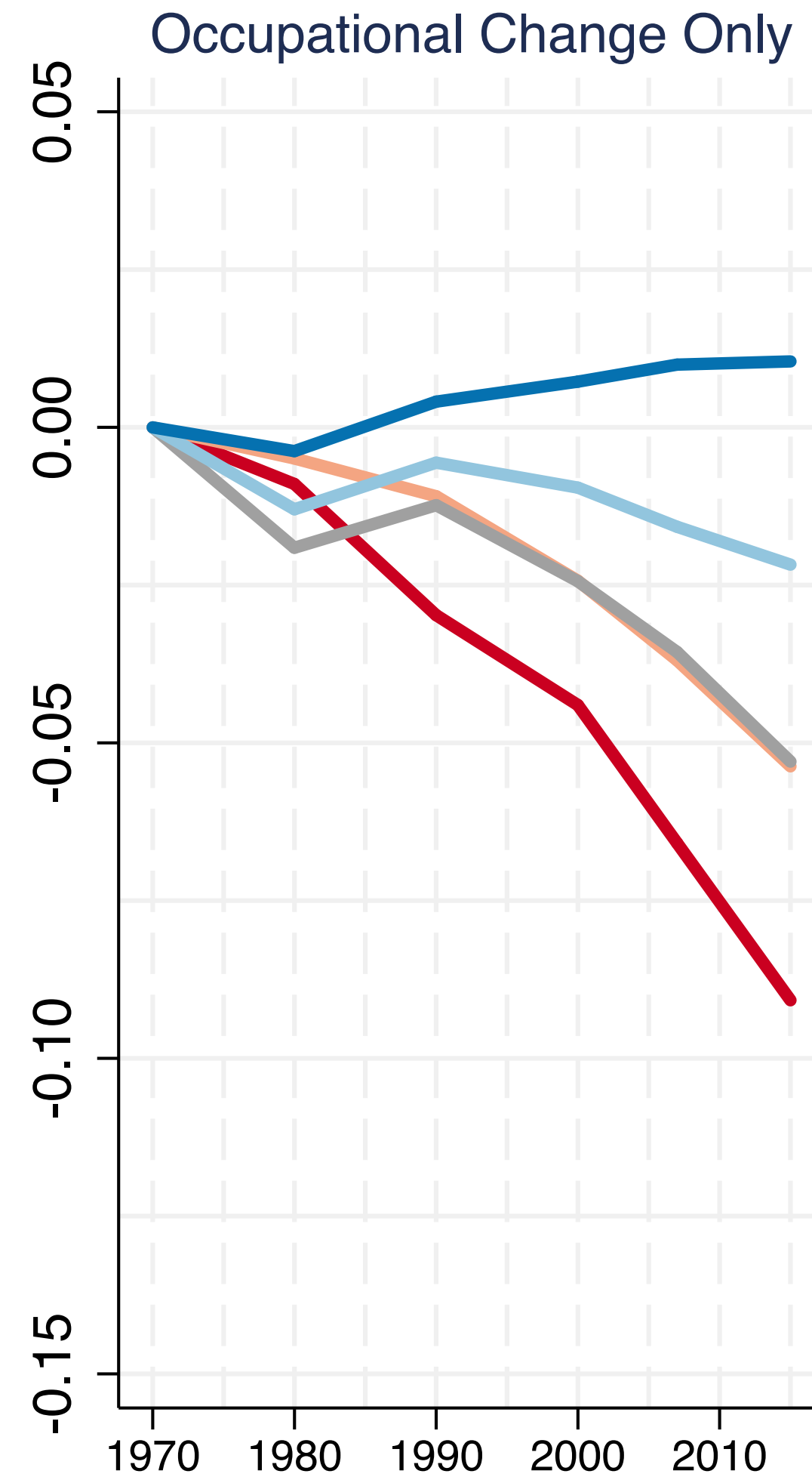
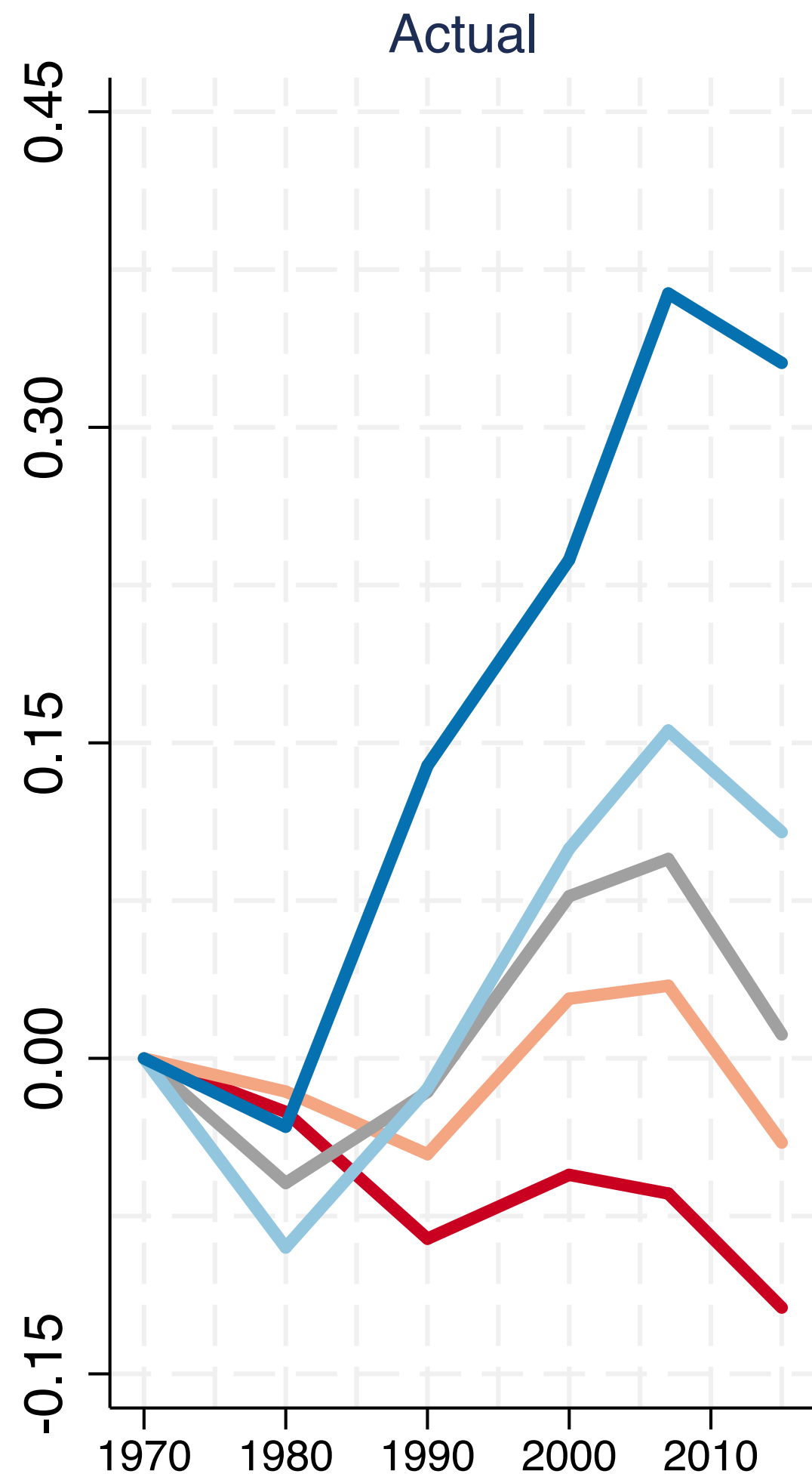
# Log Real Earnings of Foreign Born Working Age Adults (\$2015)

## Wages of Foreign-Born Workers

- **Foreign-Born College Educated**
- **Foreign-Born Non-College Educated**



# Observed and Counterfactual Changes in Log Hourly Wages, 1970-2015



## Can Job Polarization Explain Diverging Wages by Education?

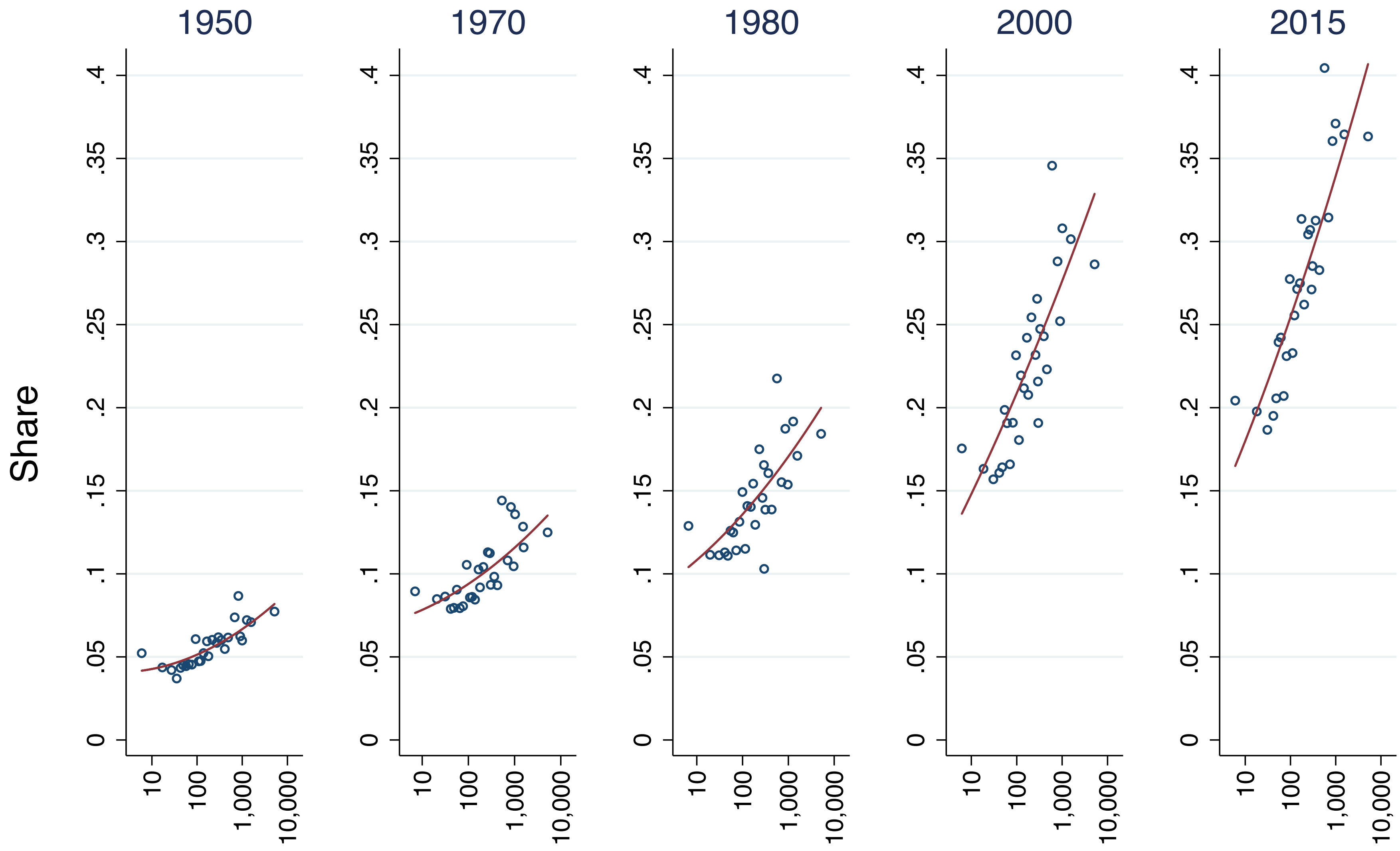
- **Qualitatively**
  - YES
- **Quantitatively**
  - Accounting for *where* work happens helps!

III.

The Changing Geography  
of Workers

In progress work with Juliette Fournier  
MIT Department of Economics

# College Educated Share of Working-Age Population



Log Population Density (1970)

**Urban Areas Have Become Much More Educated since 1980**

## 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

(Age structure slides  
currently embargoed... sorry)

IV.

What and Where is the

Work of the Future

In progress work with Anna Salomons  
Utrecht University, the Netherlands

# What are the Jobs of the Future?

## I. Frontier Jobs



## Robotic Systems Integration Lead

Veo Robotics

Boston, MA

via Glassdoor

🕒 15 days ago 📁 Full-time



## Integration & Test Engineer

Veo Robotics

Boston, MA

via Glassdoor

🕒 22 days ago 📁 Full-time



## Solutions Integration Engineer

RightHand Robotics

Somerville, MA

via Glassdoor

🕒 6 days ago 📁 Full-time



## Frontier Jobs Added by Decade

- Supervisor, Word Processing ('80)
- Controller, Remotely-Piloted Vehicle ('80)
- Circuit Layout Designer ('90)
- Robotic Machine Operator ('90)
- Artificial Intelligence Spclst ('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**



## Integrative Medicine Animal Rehabilitation Therapist

University of California, Davis

Los Angeles, CA

via Los Angeles CA Free Classifieds Ads...

🕒 3 days ago 📁 Full-time



## 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)



## Social Worker/Therapist- Animal Therapy

Princeton HealthCare System

Hamilton, MA

via CareerBuilder

🕒 13 days ago



## Social Worker/Therapist- Animal Therapy

Princeton HealthCare System

Princeton, NJ

via Glassdoor



# What are the Jobs of the Future?

I. Frontier Jobs

II. Wealth Work

III. Last Mile Jobs



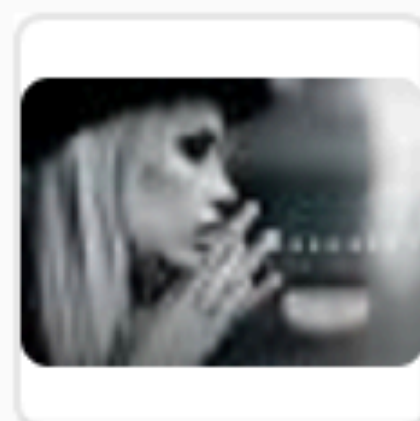
## Kids Content Tagger

Netflix

Remote, OR

via Career Square

🕒 Over 1 month ago 📁 Full-time



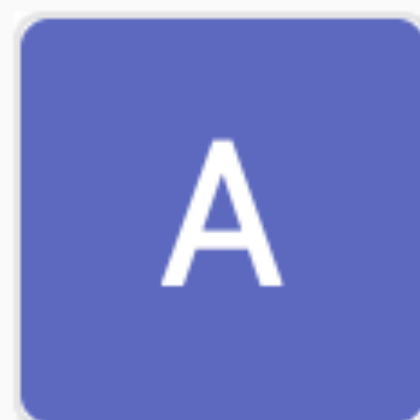
## Data entry/ Tagger assistant

KALLATI

North Hempstead, NY

via ZipRecruiter

🕒 Over 1 month ago 💰 \$ 12–15 an hour



## Content Tagger

Axius Technologies Inc

New York, NY

via EmployZone

🕒 Over 1 month ago 📁 Full-time



## 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)

	<b>All Jobs</b>	<b>Frontier Jobs</b>	<b>Wealth Work</b>	<b>Last Mile Jobs</b>
<b>Wage (\$2015)</b>	<b>\$18.78</b>	<b>\$26.89</b>	<b>\$18.49</b>	<b>\$15.29</b>
<b>Pct Women</b>	<b>44%</b>	<b>28%</b>	<b>62%</b>	<b>43%</b>
<b>Pct College</b>	<b>35%</b>	<b>50%</b>	<b>41%</b>	<b>15%</b>
<b>Pct HS Graduate</b>	<b>26%</b>	<b>16%</b>	<b>21%</b>	<b>38%</b>
<b>Pct of Jobs</b>	<b>100.0%</b>	<b>5.1%</b>	<b>6.8%</b>	<b>1.2%</b>

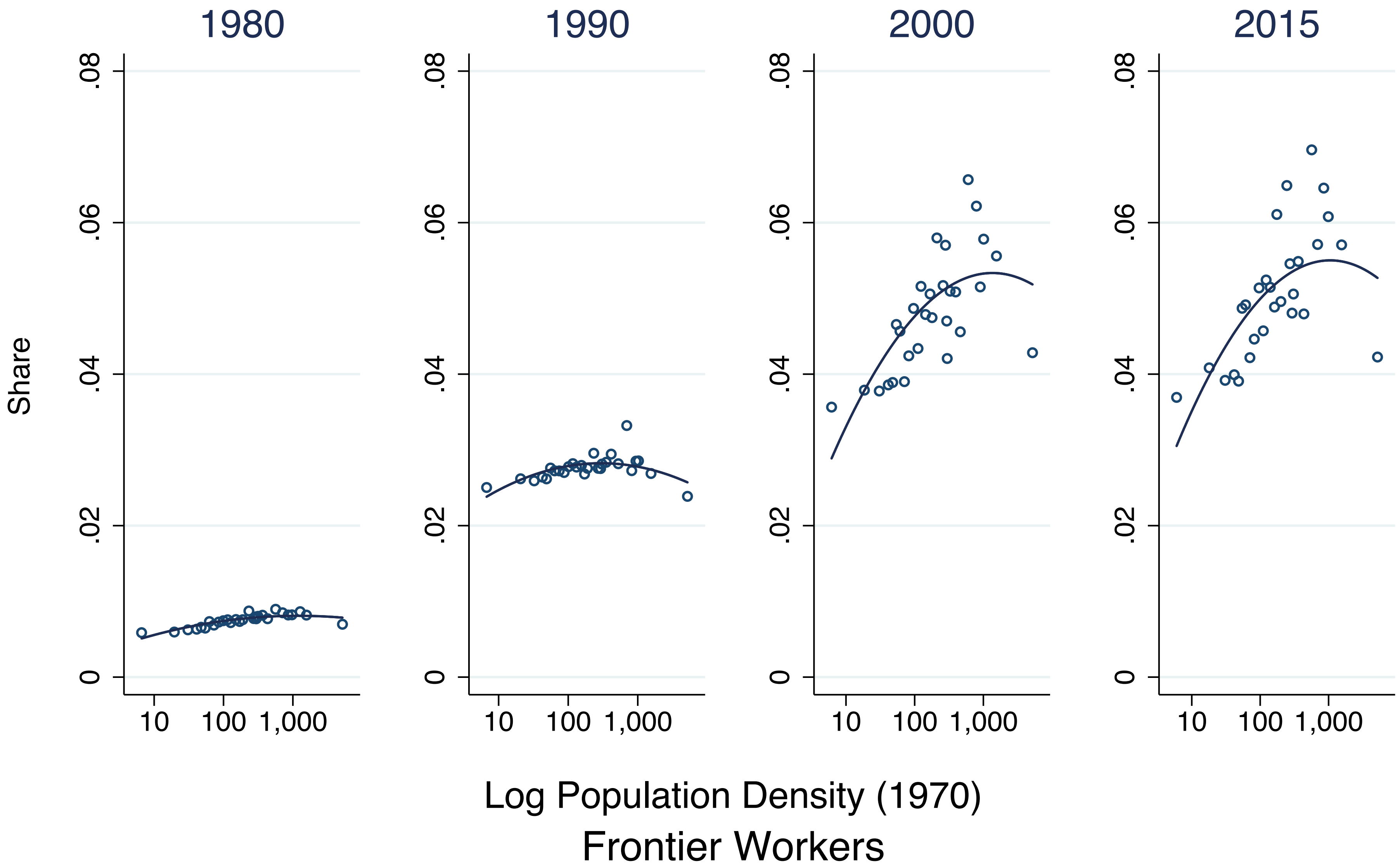
# Employment Shares in New Census Job Titles (Cumulative)

Working Age Adults

# Work of the Future

## 1. Frontier Workers

- Programmer-Analyst



# Employment Shares in New Census Job Titles (Cumulative)

## Working Age Adults

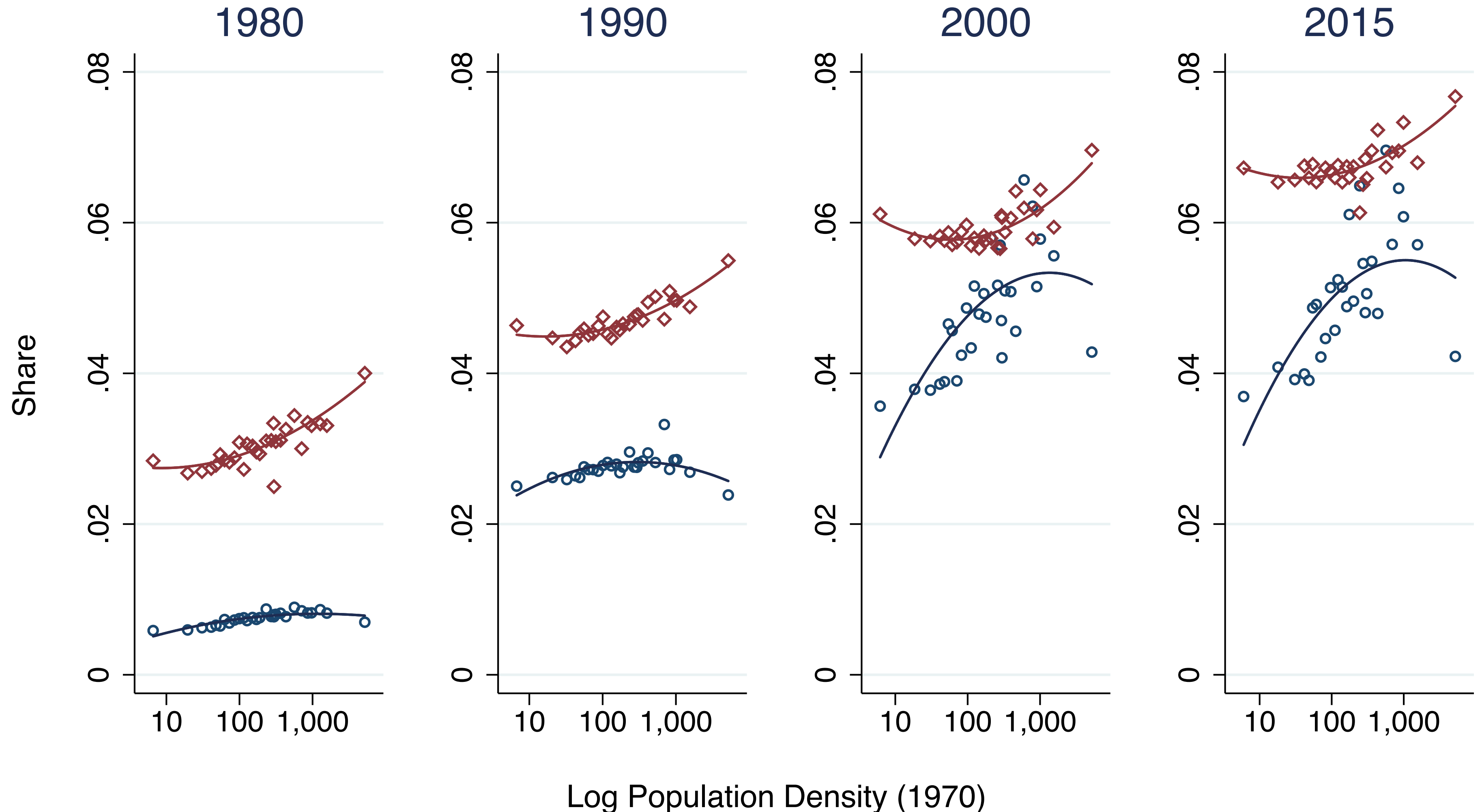
# Work of the Future

## 1. Frontier Workers

- Programmer-Analyst

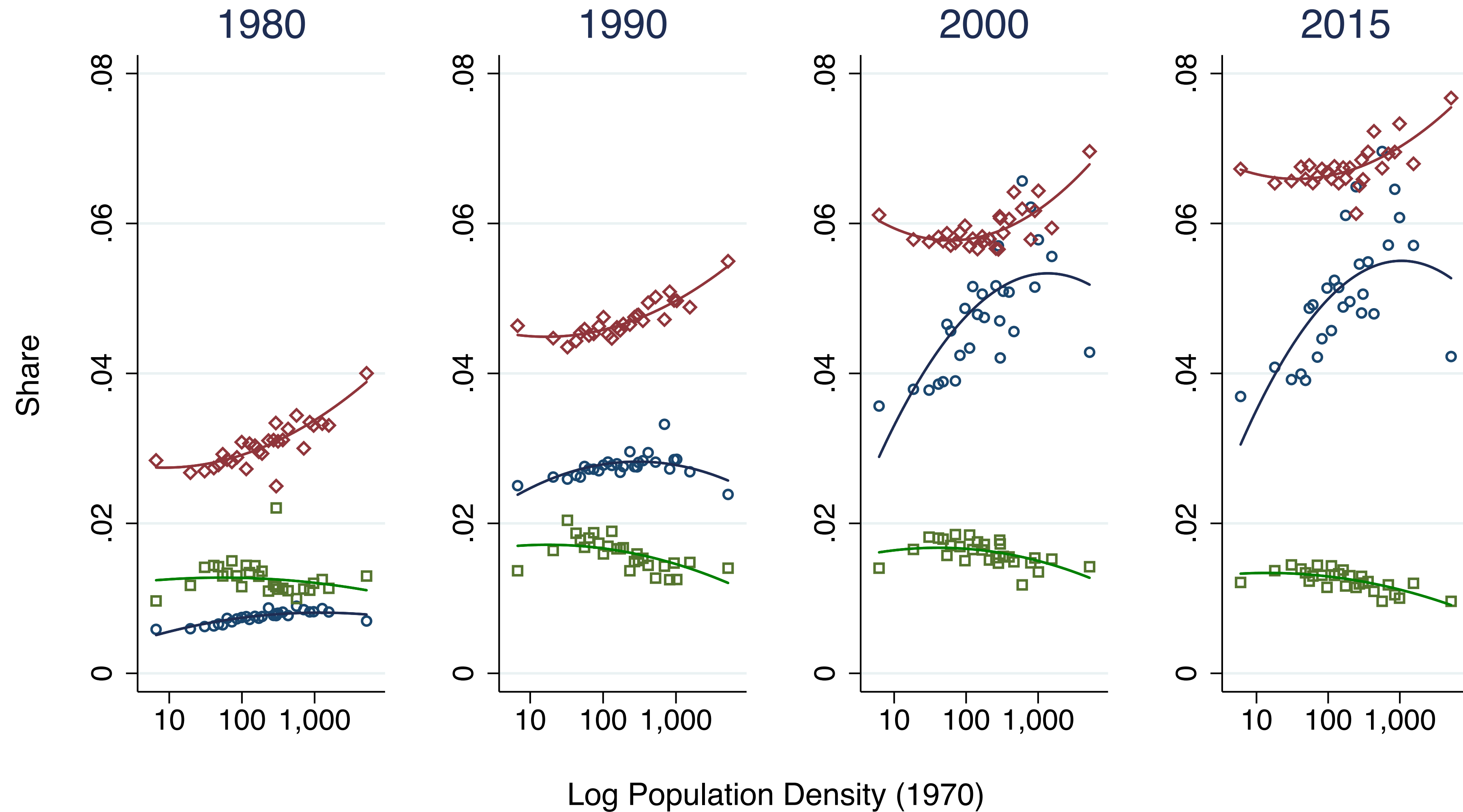
## 2. Wealth Workers

- Barista



# Employment Shares in New Census Job Titles (Cumulative)

## Working Age Adults



## Work of the Future

### 1. Frontier Workers

- Programmer-Analyst

### 2. Wealth Workers

- Barista

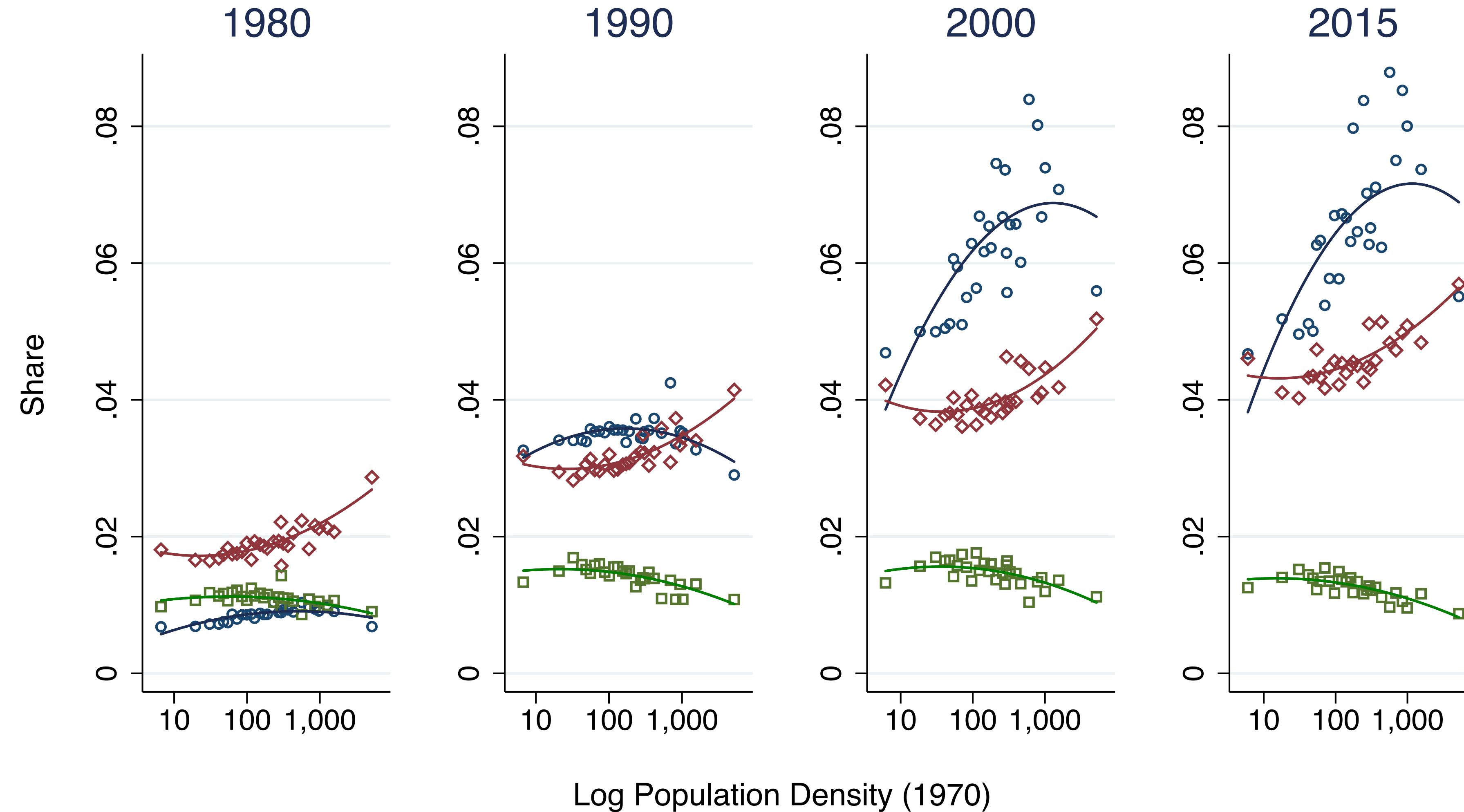
### 3. Last Mile Workers

- Inspector-Hand Packager



# Employment Shares in New Census Job Titles (Cumulative)

## Working Age Men



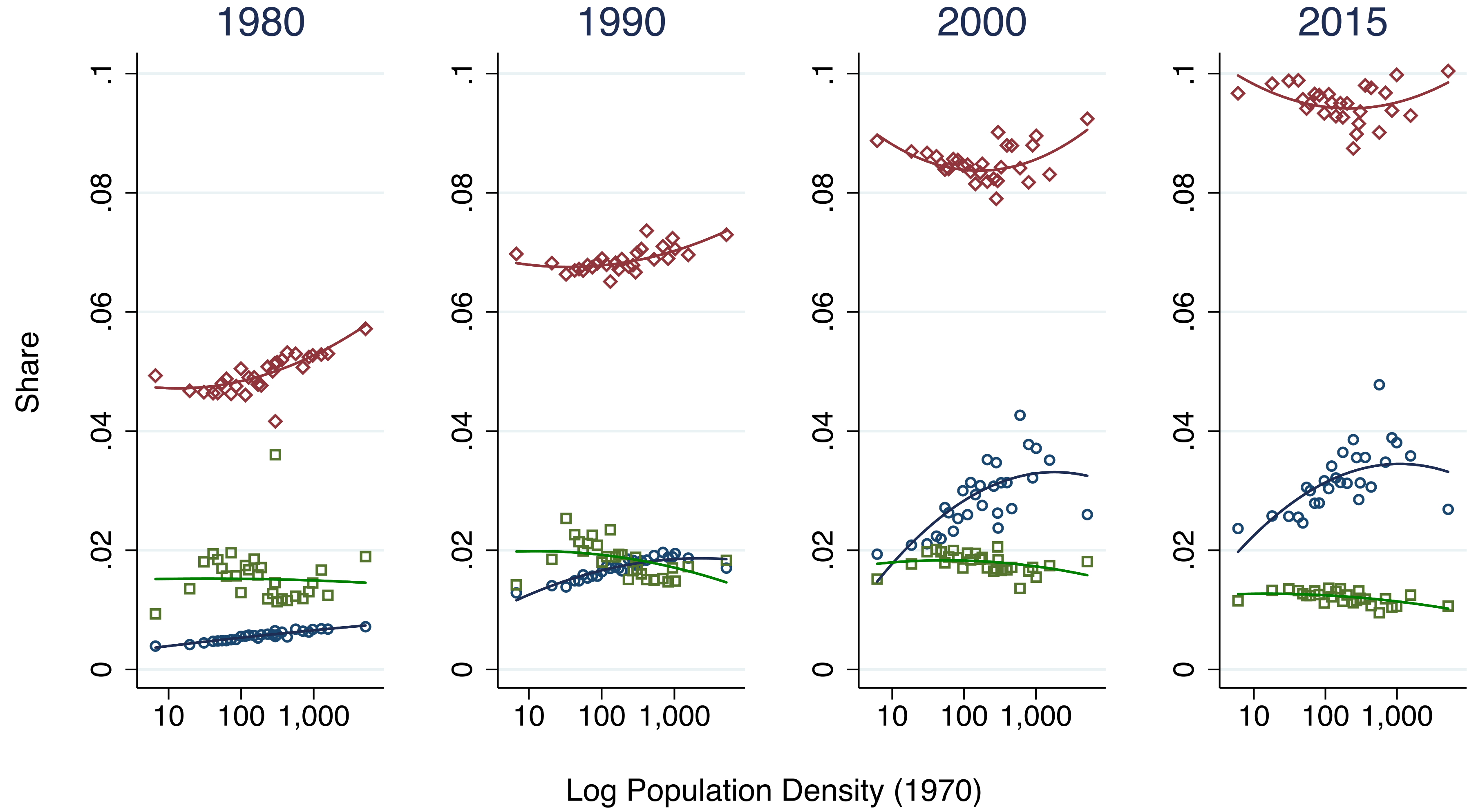
**Most Prevalent  
Category among  
Men is  
'Frontier Work'**

**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 Hourly Wages in New Census Job Titles (Cumulative)

## Working Age Adults

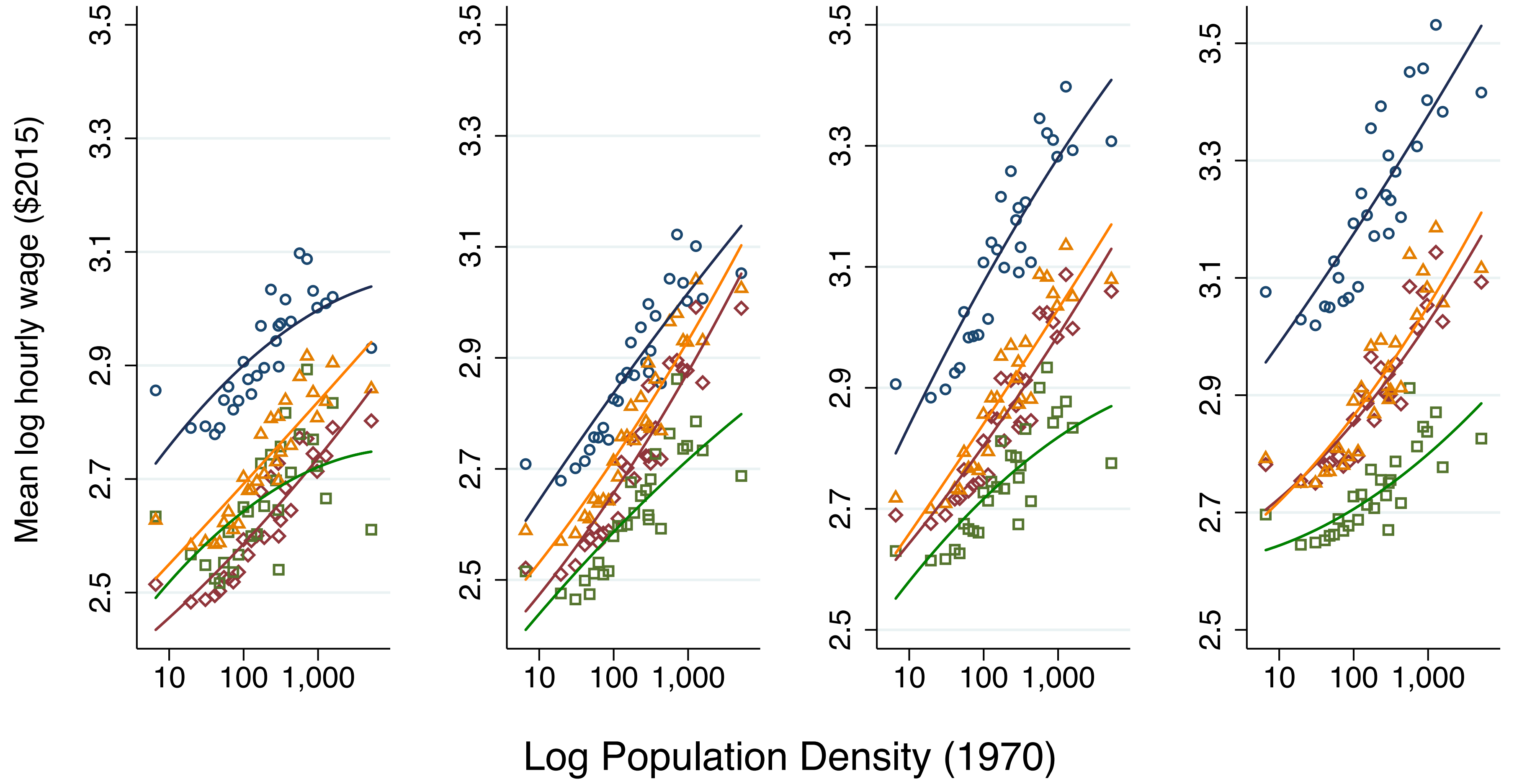
# Wages of Workers to New Work

1980

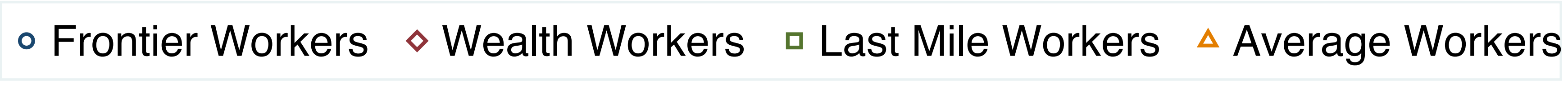
1990

2000

2015



- 1. Frontier Workers**
  - Programmer-Analyst
- 2. Wealth Workers**
  - Barista
- 3. Last Mile Workers**
  - Inspector-Hand Packager
- 4. Average Workers**



# Summary: Challenges, Opportunities

# 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

# Challenges and Opportunities

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  - But not for less-educated workers — a critical change

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- 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

# Challenges and Opportunities

- 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?
  - Not a clear 'land of opportunity' for non-college adults
  - Conjecture: Falling geo mobility reflects this new reality
- II. Jobs versus careers — A challenge and an opportunity
  - Rebuilding career paths for non-college workers

Thank you