Technological Change and The U.S. Labor Market

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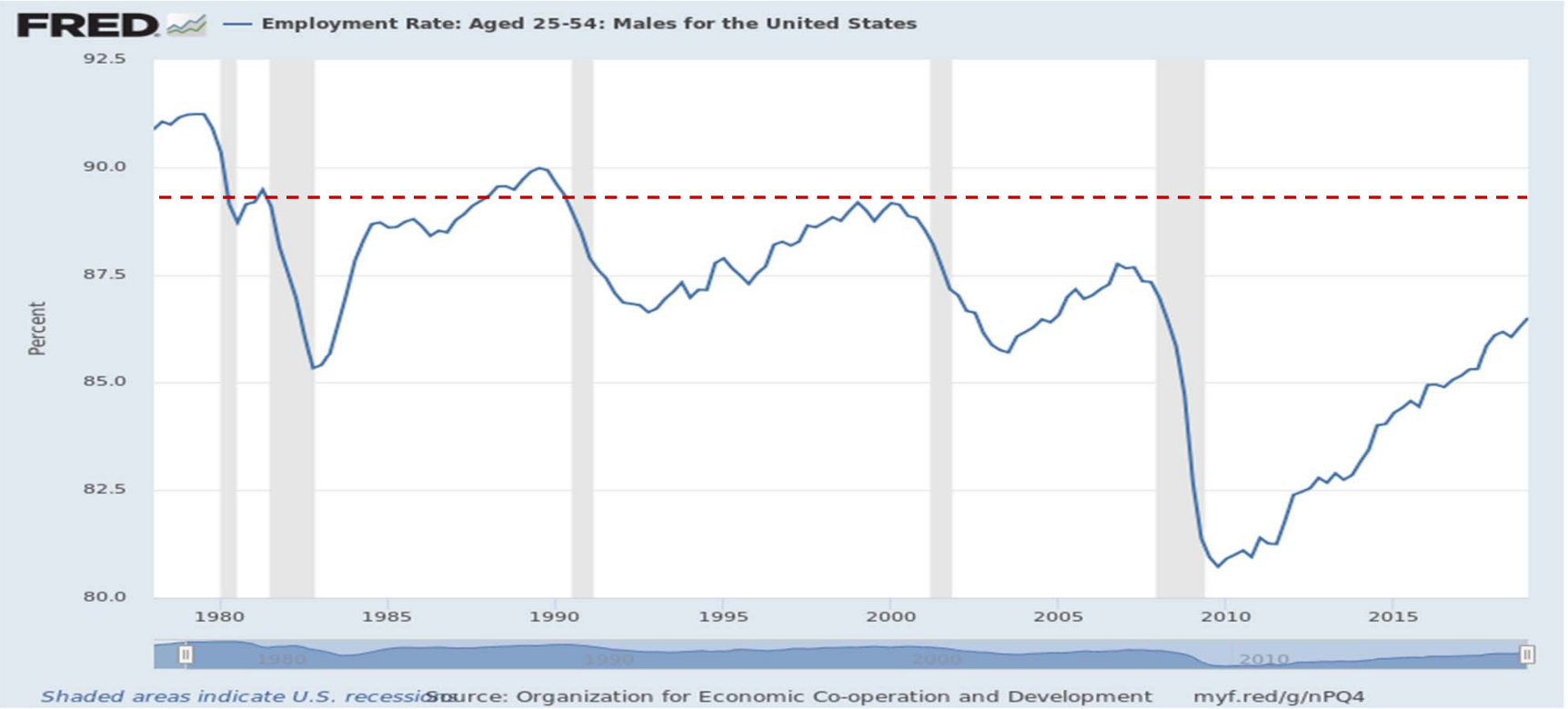
Employment to Population Ratio, Men 25-54
1978Q1 – 2019Q1



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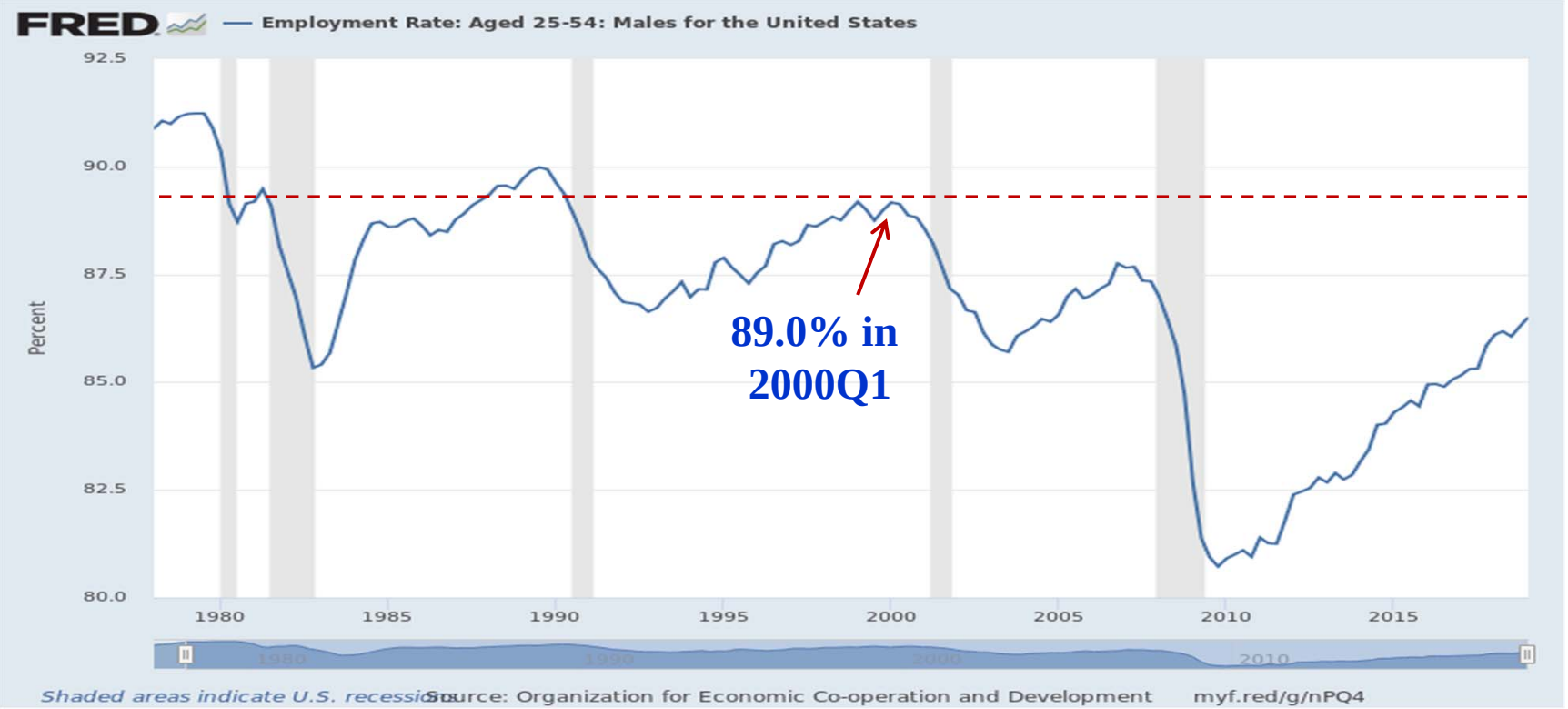

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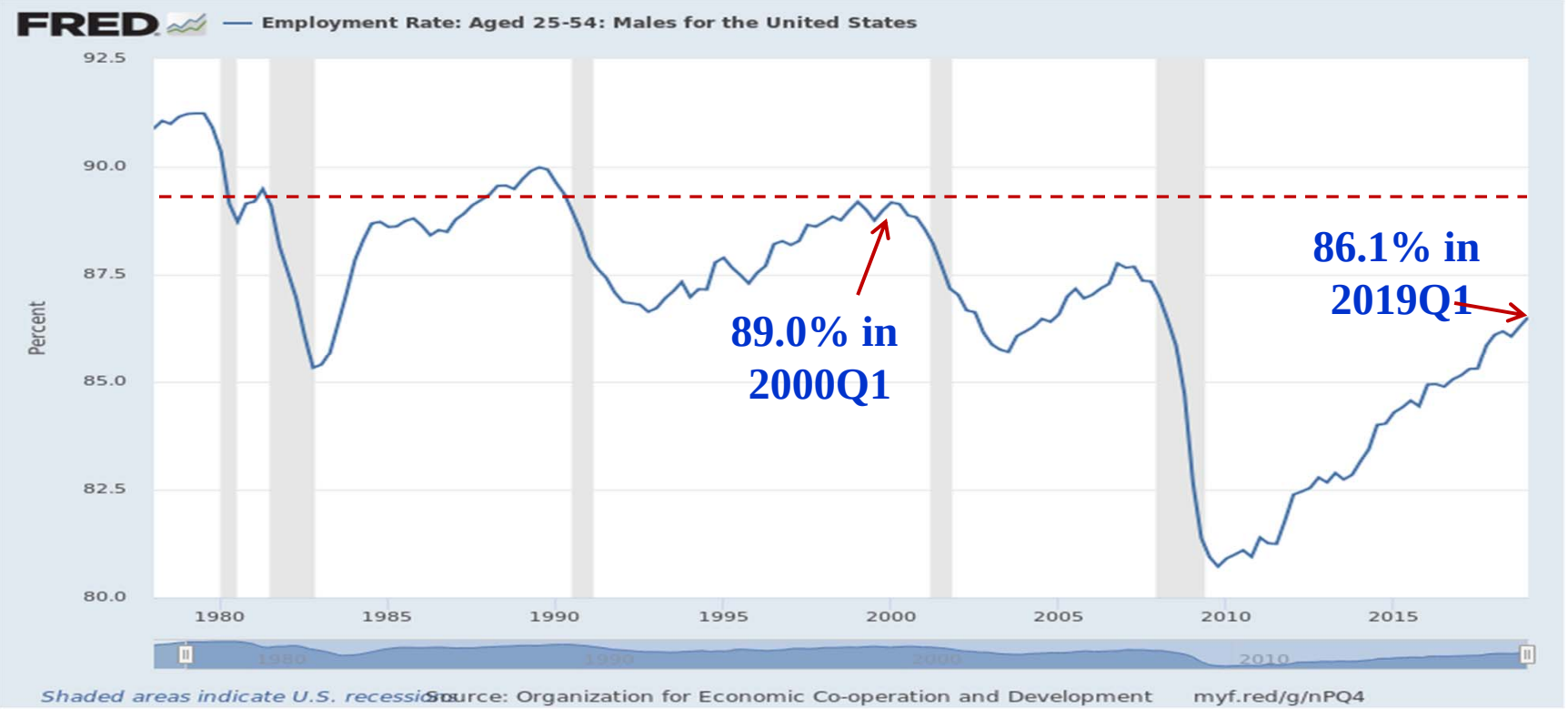

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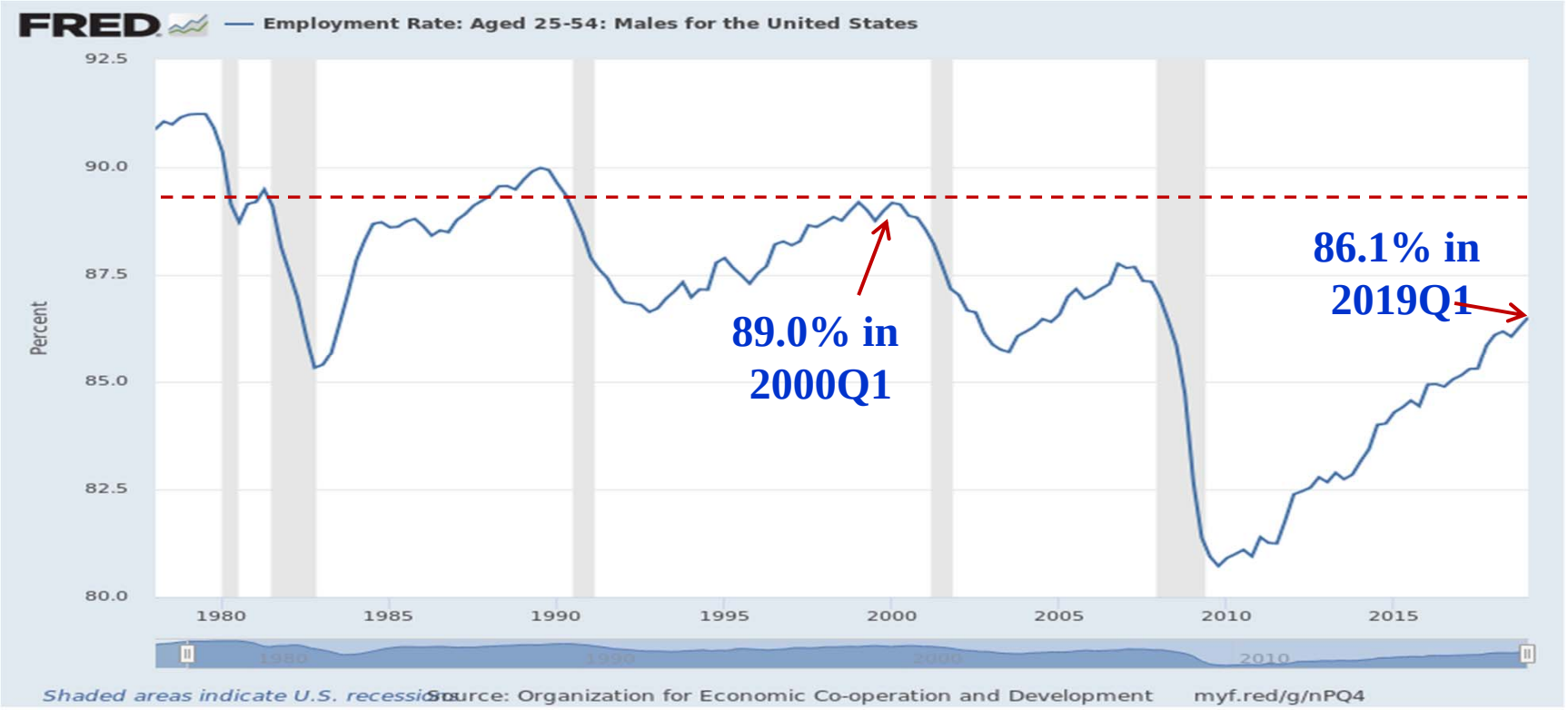
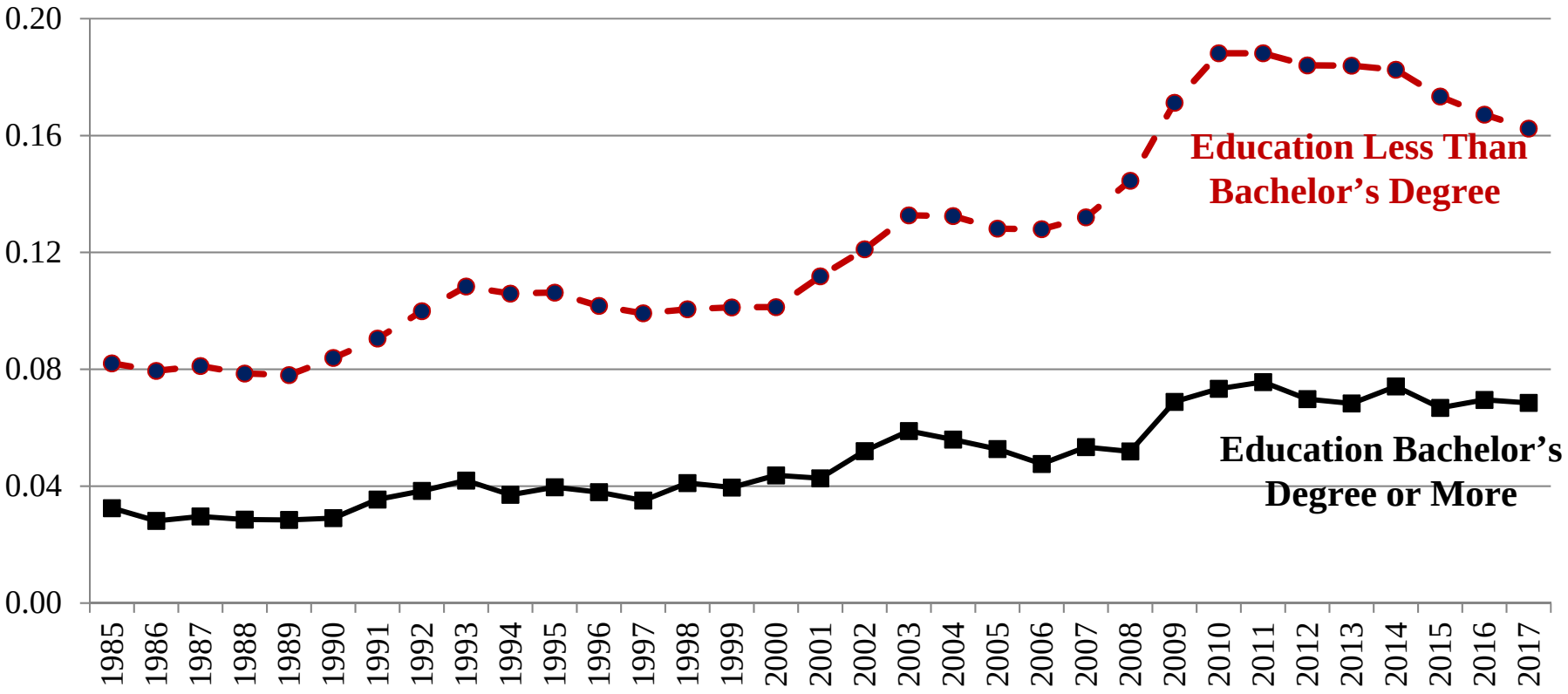


About 1.5 million men aged 25-54 are not working in 2019 relative to 2000

Fraction with Zero Weeks Worked, Men 21-54 By Education



Employment to Population Ratio, Women 25-54
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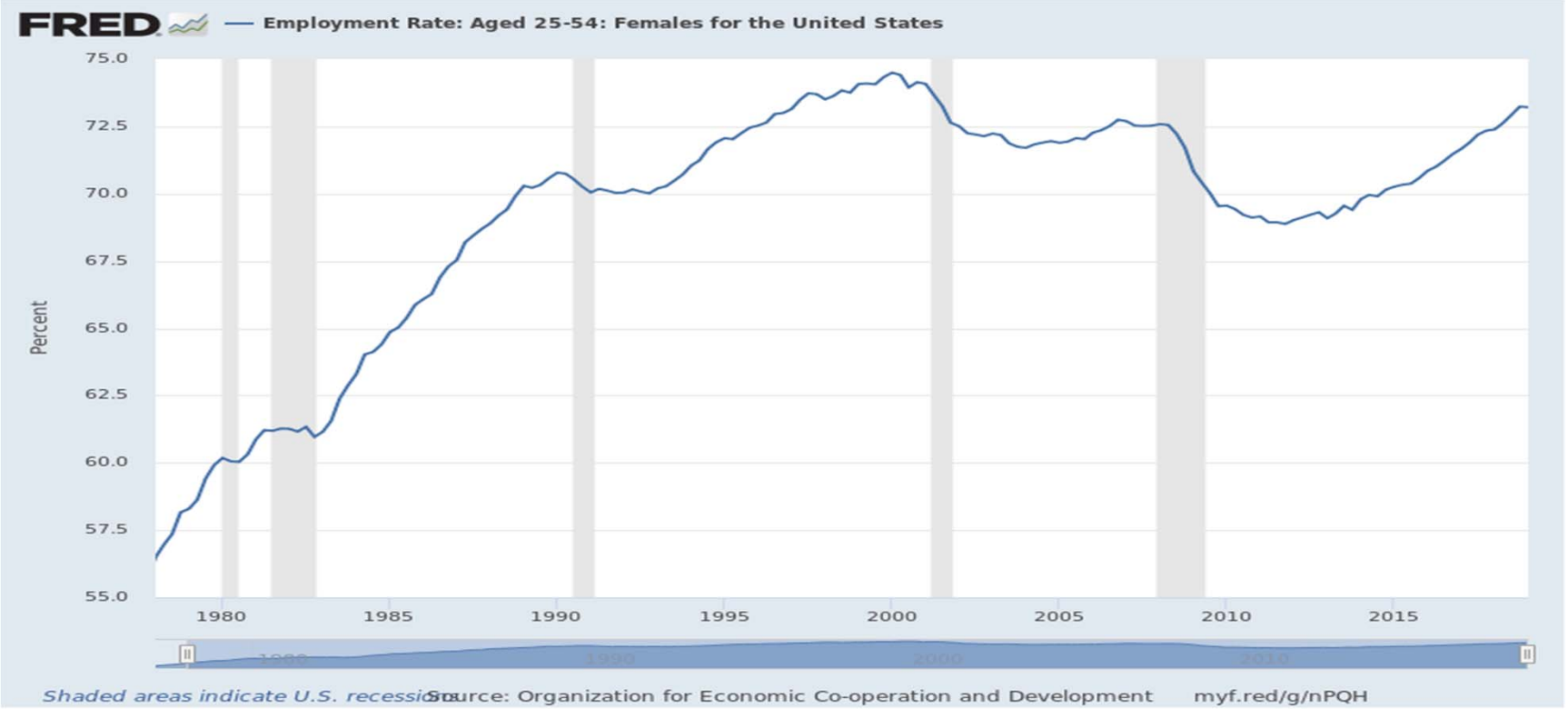

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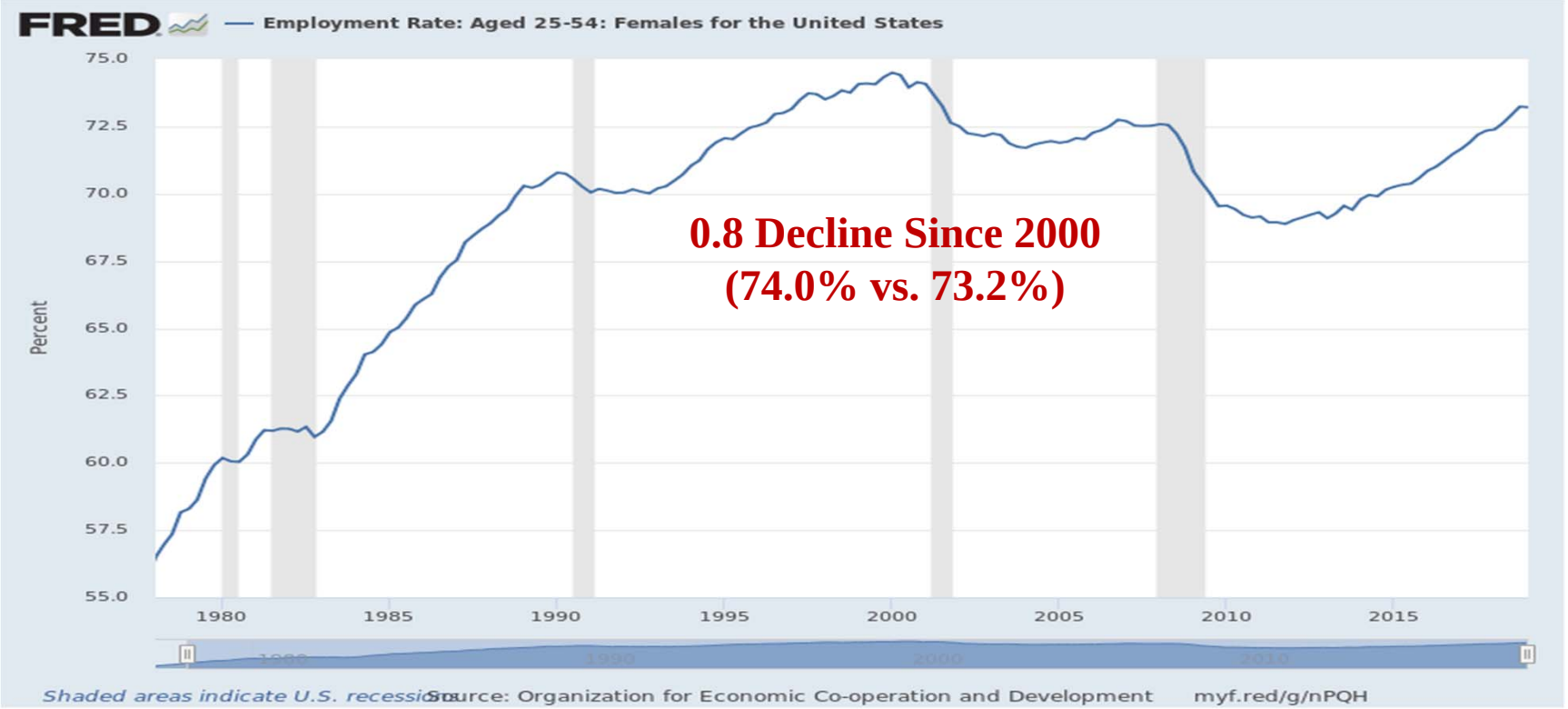

About 400,000 prime age women are not working in 2019 relative to 2000

Change in Employment to Population Ratio 2000-2018, By Age and Group

	Age 21-30	Age 31-55
Men		
Less than Bachelors	-0.065	-0.034
Bachelors or More	-0.029	-0.022
Women		
Less than Bachelors	-0.054	-0.020
Bachelors or More	-0.023	-0.004

Note: For 21-30 year old, include those enrolled in schooling as being employed

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Questions

1. **Why are employment to population ratios still depressed 10 years after the Great Recession has ended?**

    - "Cyclical" forces (due to the recession)
    - "Structural" forces (due to other longer run trends)

2. **Why are the declines in employment to population ratios concentrated among lower educated workers (as opposed to higher educated workers)?**

3. **Why are the declines in employment to population ratios concentrated among the young (as opposed to older workers)?**

Plan Today

- **Highlight some of my research trying to understand the decline in employment rates during the 2000s.**

  Part 1: Technology's Effect on Labor Demand

  - Focus on how technology has reshaped the manufacturing sector which reduced **labor demand**.

  Part 2: Have a Broader Discussion of the Macroeconomic Implications of these Trends

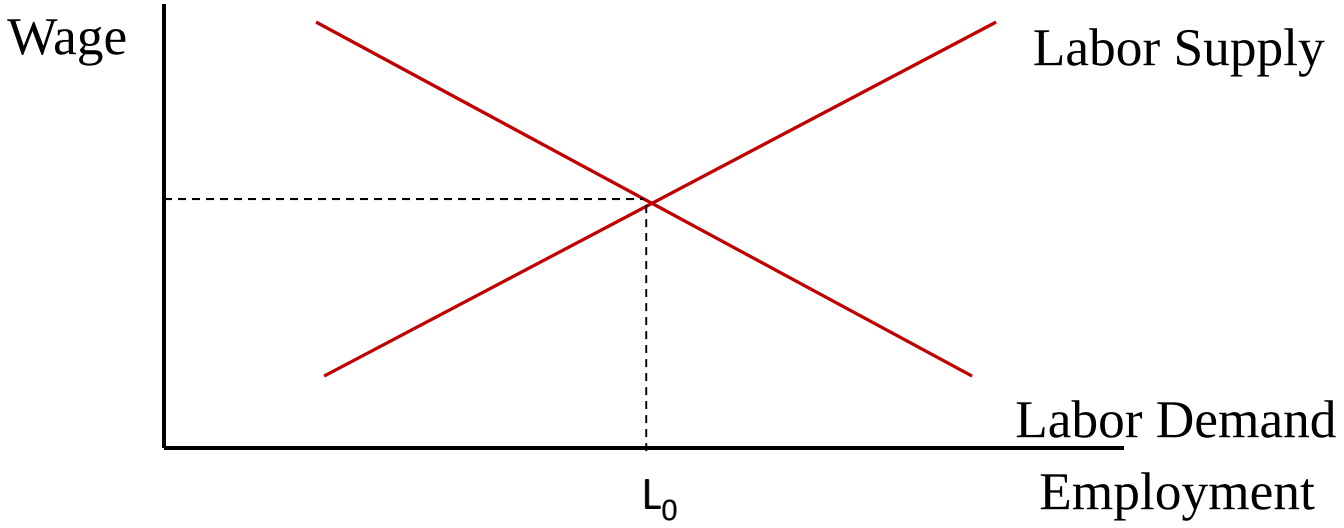
  Part 3: Technology's Potential Effect on Labor Supply

Part 1:
Technology and Labor Demand

How Does Technology Affect Labor Demand?

- **Depends….**
- **Does the new technology "complement" labor in production?**
  - Improving technologies may make some occupations more productive.
  - Think about medical occupations. Online medical records, new imaging procedures, etc. have likely made doctors more productive.
- **Does the new technology "substitute" labor in production?**
  - Improving technologies may displace workers.
  - Think about robots. Automation has allowed firms to produce more output with less workers.

Technology and Low Skilled Labor Markets



- **Labor Demand:** **Determined by firms**

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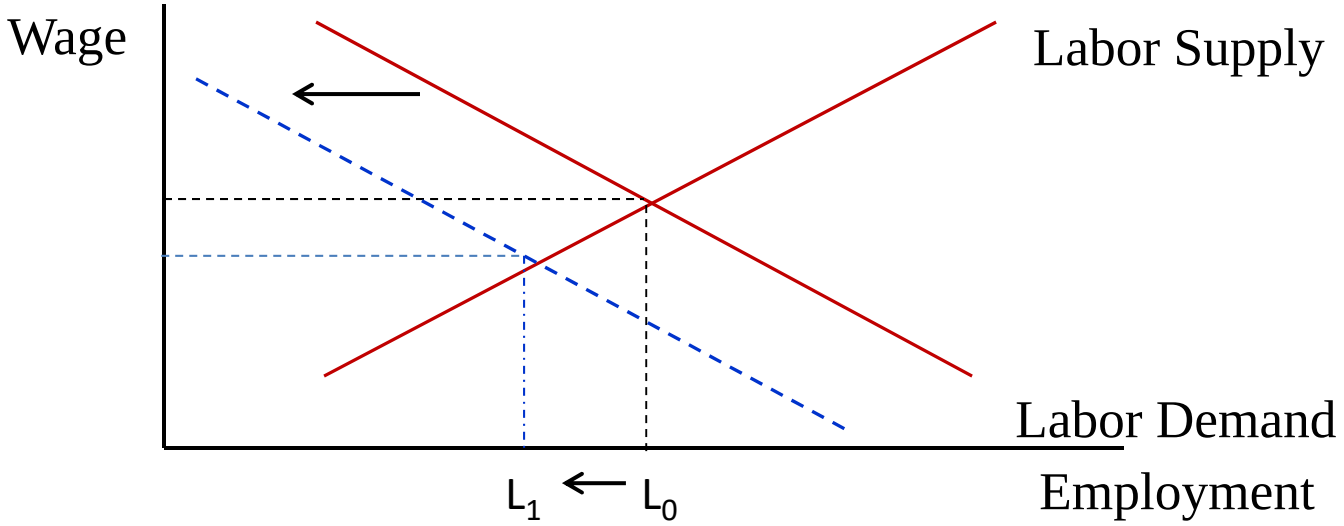
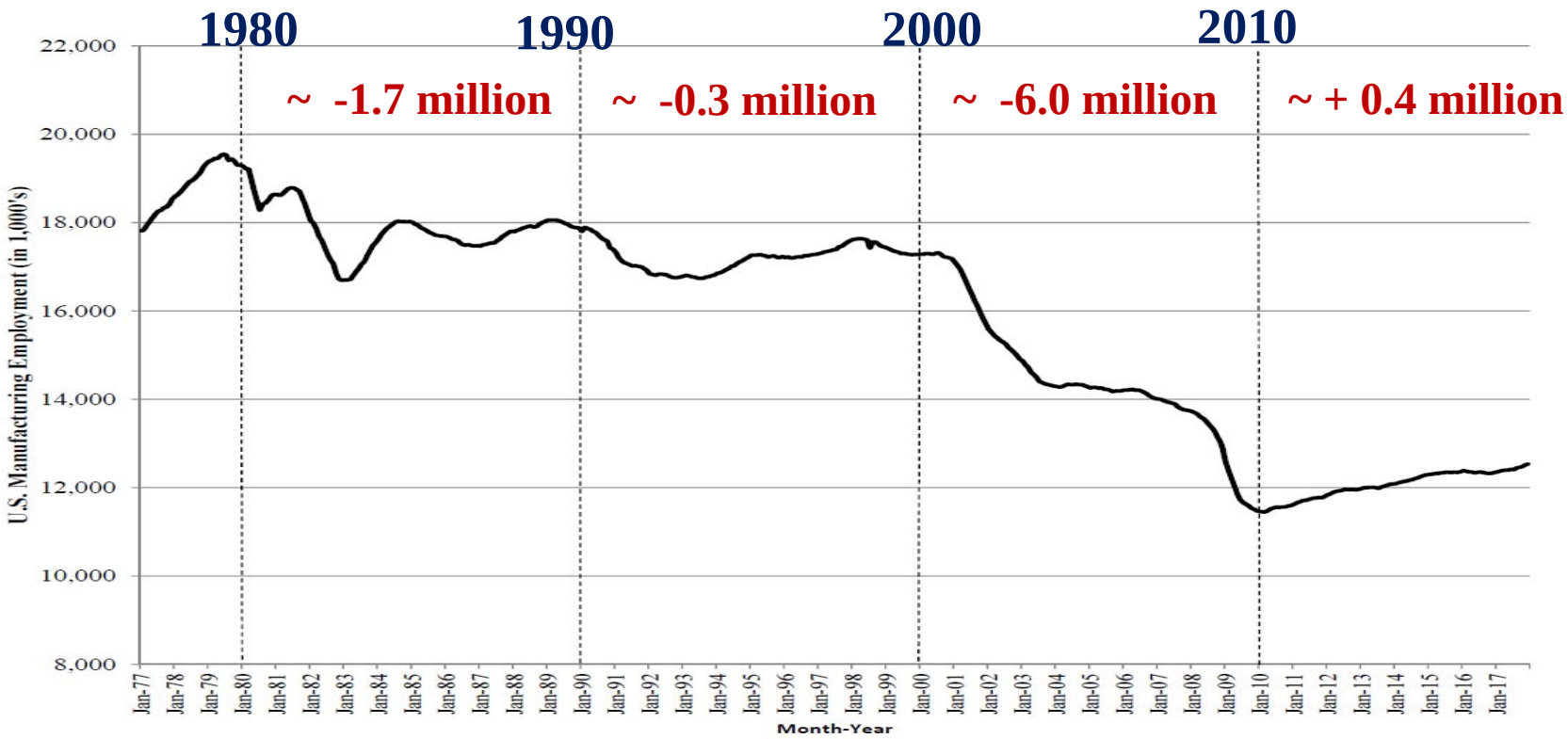


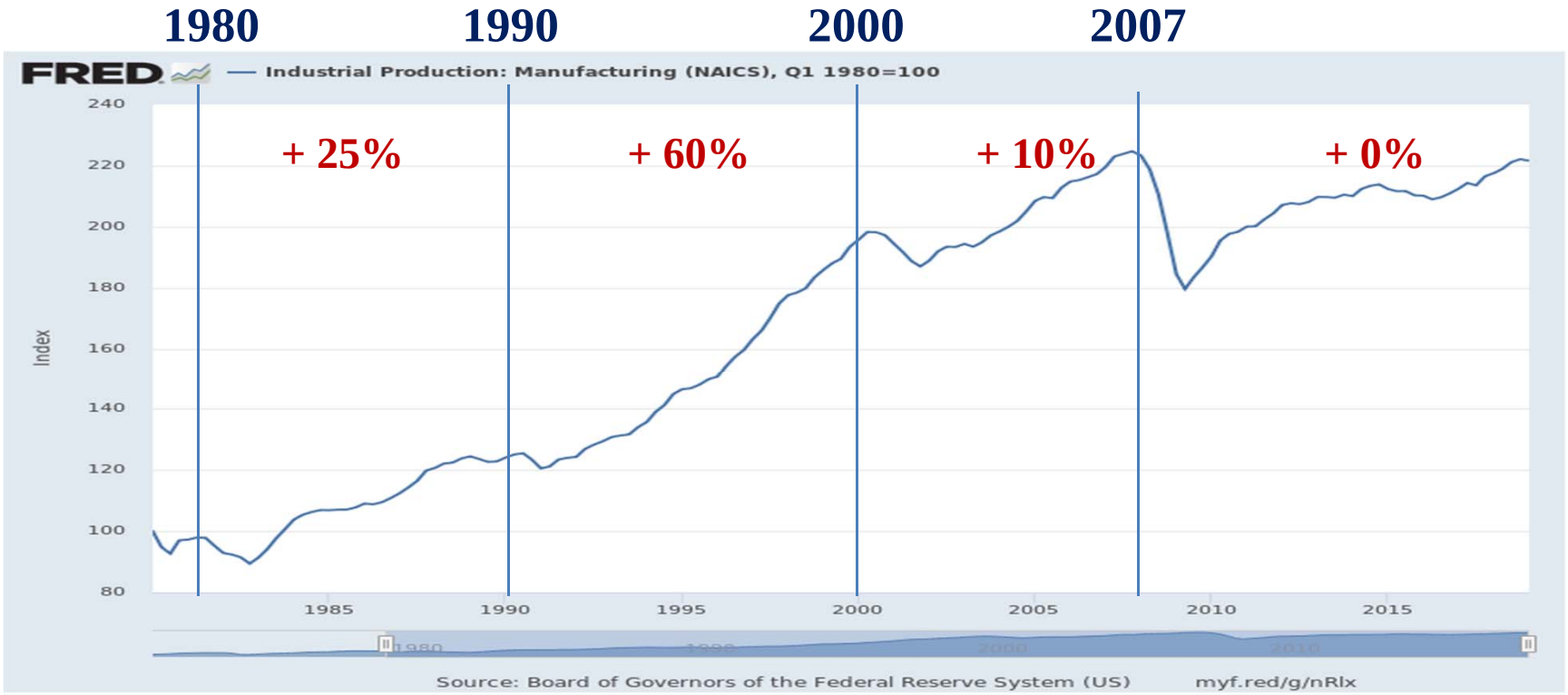
- **Labor Demand:** **Determined by firms**
  Falls if technology displaces workers
- **Fall in labor demand:** **Reduce employment and wages**

Question:
Did Automation in Manufacturing Reduce Aggregate Employment Rates?

U.S. Manufacturing Employment, BLS



U.S. Manufacturing Output, Index 1980 = 100



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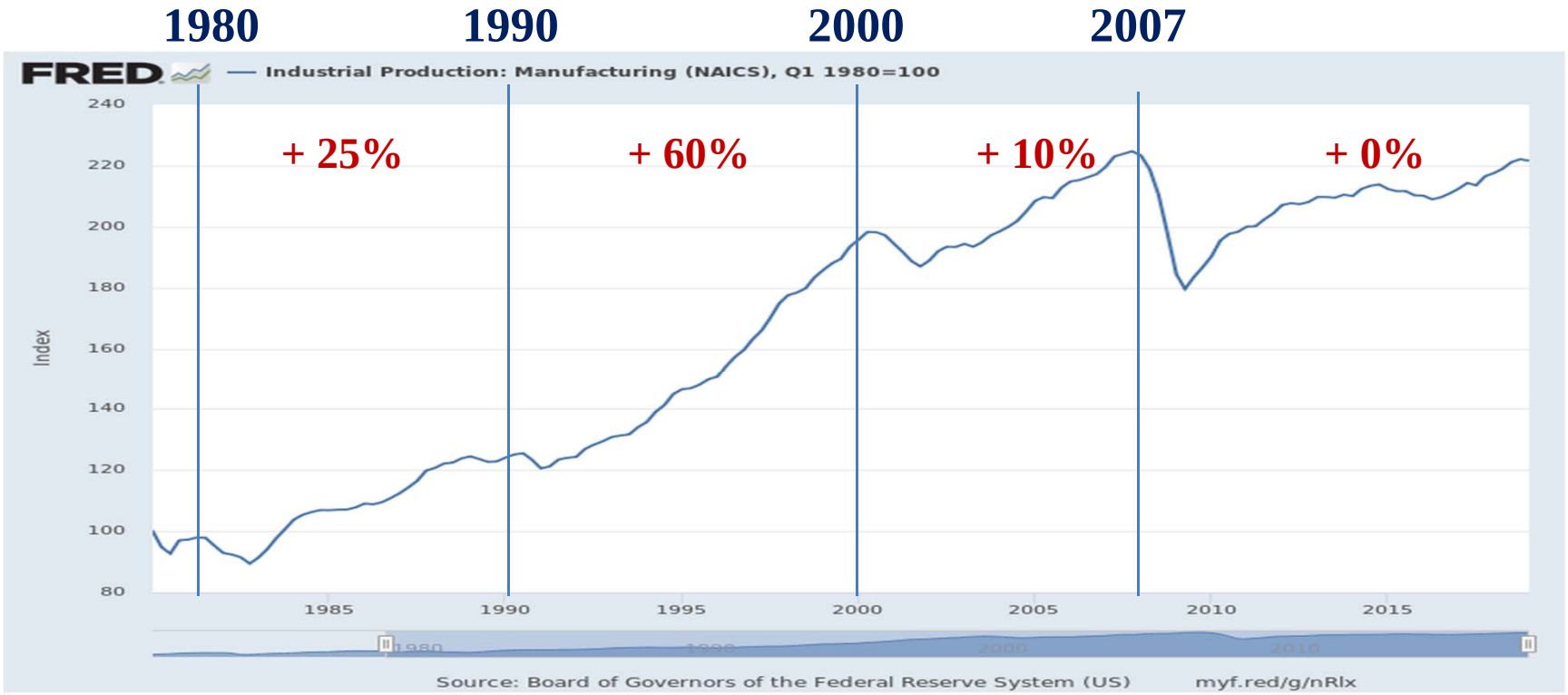
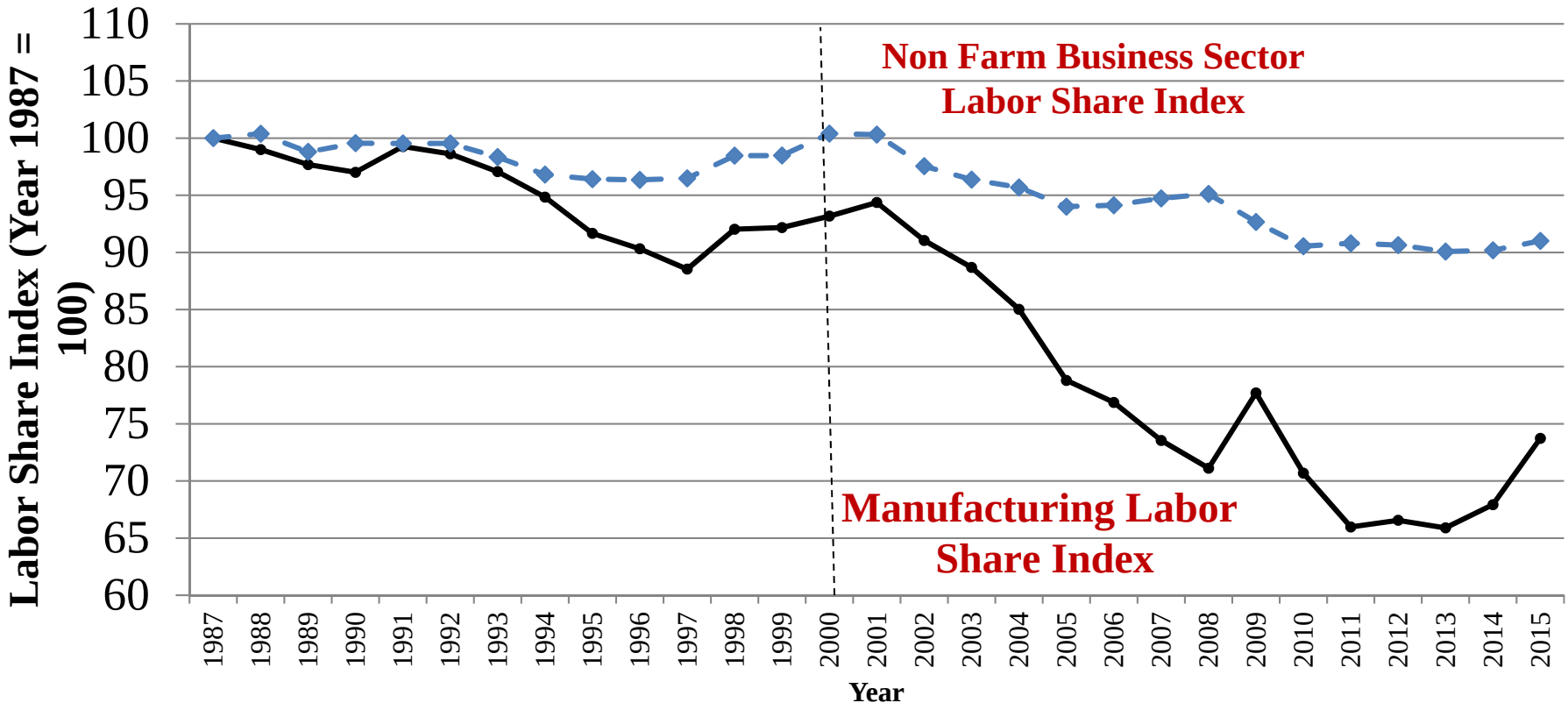


- **From 2000 to 2007, manufacturing employment <u>fell</u> by 4 million workers and manufacturing production <u>increased</u> by 10 percent!**

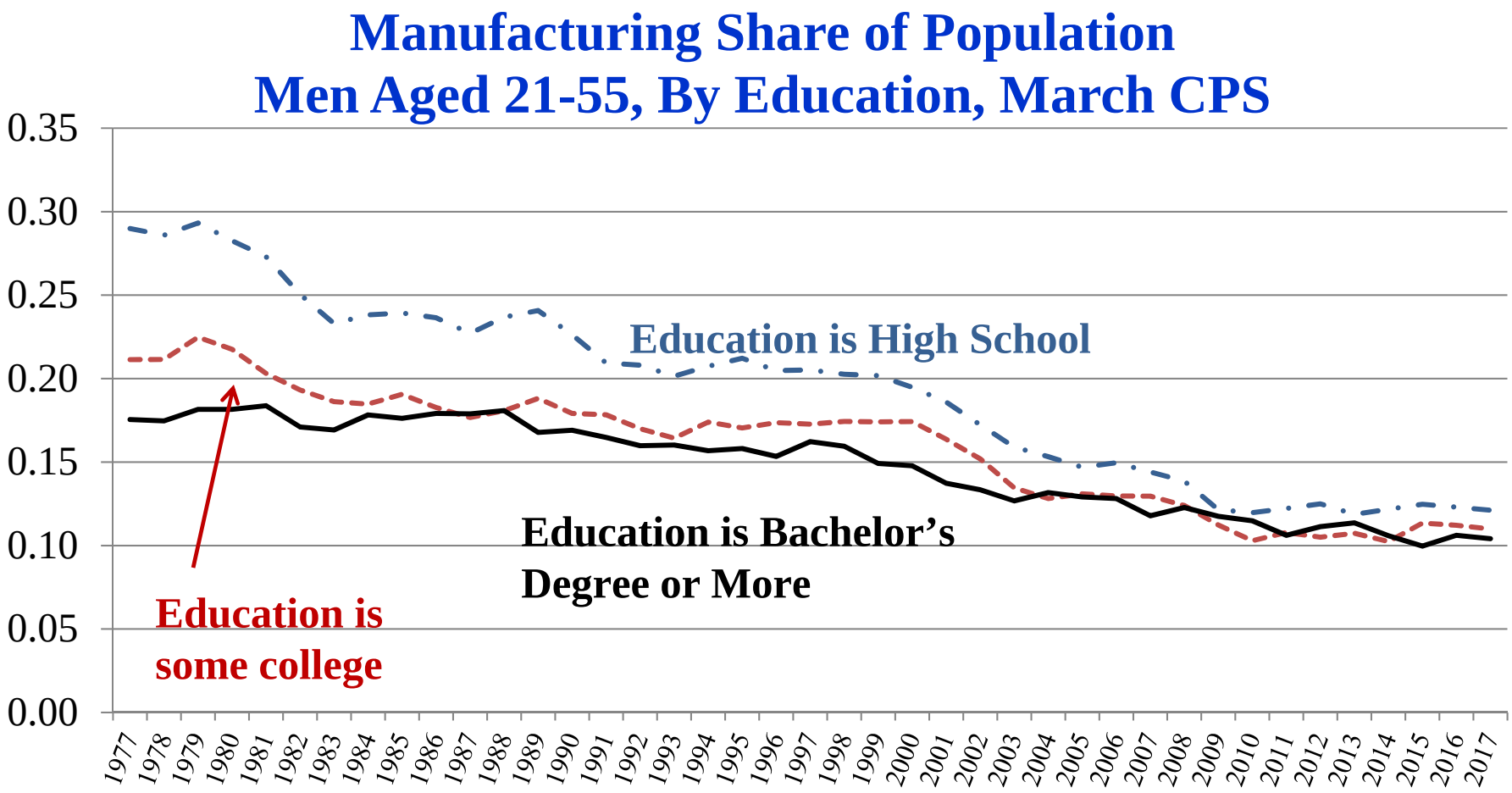
What Explains Decline in Manufacturing Post 2000-ish?

- **Trade**
  - Popular narrative
  - Some truth with respect to explaining initial decline in U.S. manufacturing.
  - **Cannot be the whole story: U.S. manufacturing output increased post 2000 despite declining employment.**
- **Automation**
  - U.S. manufacturers are producing more output with less labor input.
  - Foreign competition may have accelerated automation.
  - Automation also changed the skill mix of manufacturing jobs.

“Labor Share” in Manufacturing (Relative to Year 1987)



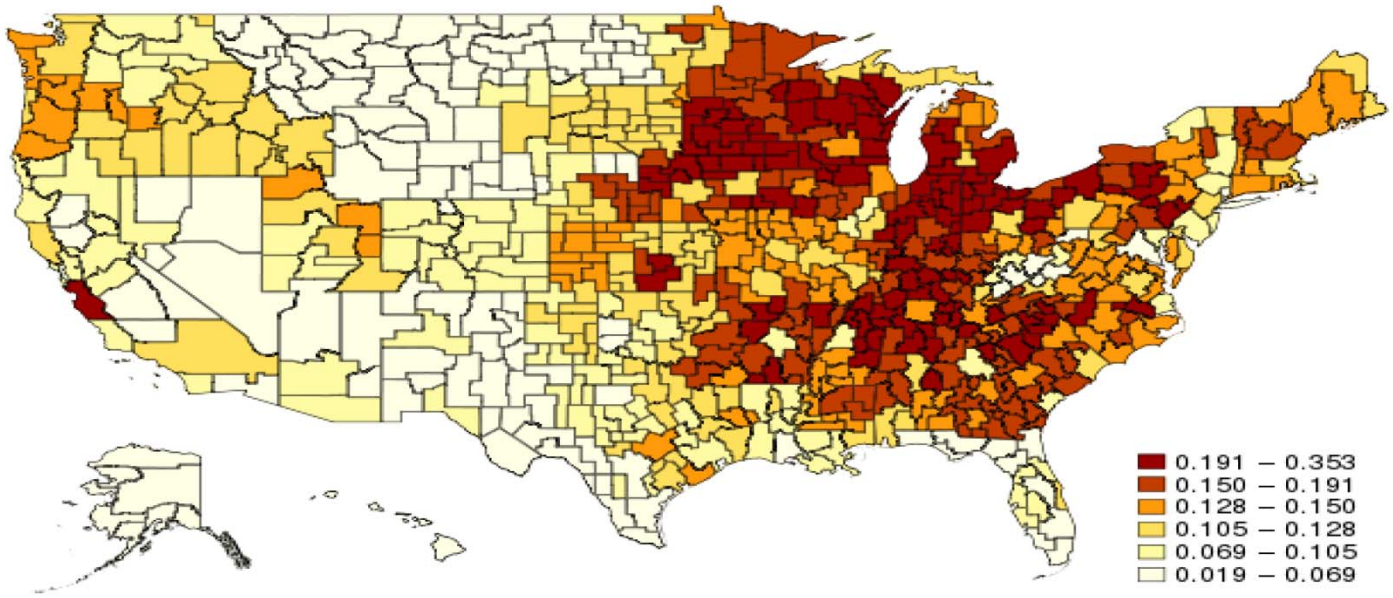
- Labor share = Value of wage bill divided by value of output.


Manufacturing Share of Population
Men Aged 21-55, By Education, March CPS
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Education is High School
Education is Bachelor's Degree or More
Education is some college
1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

Question:

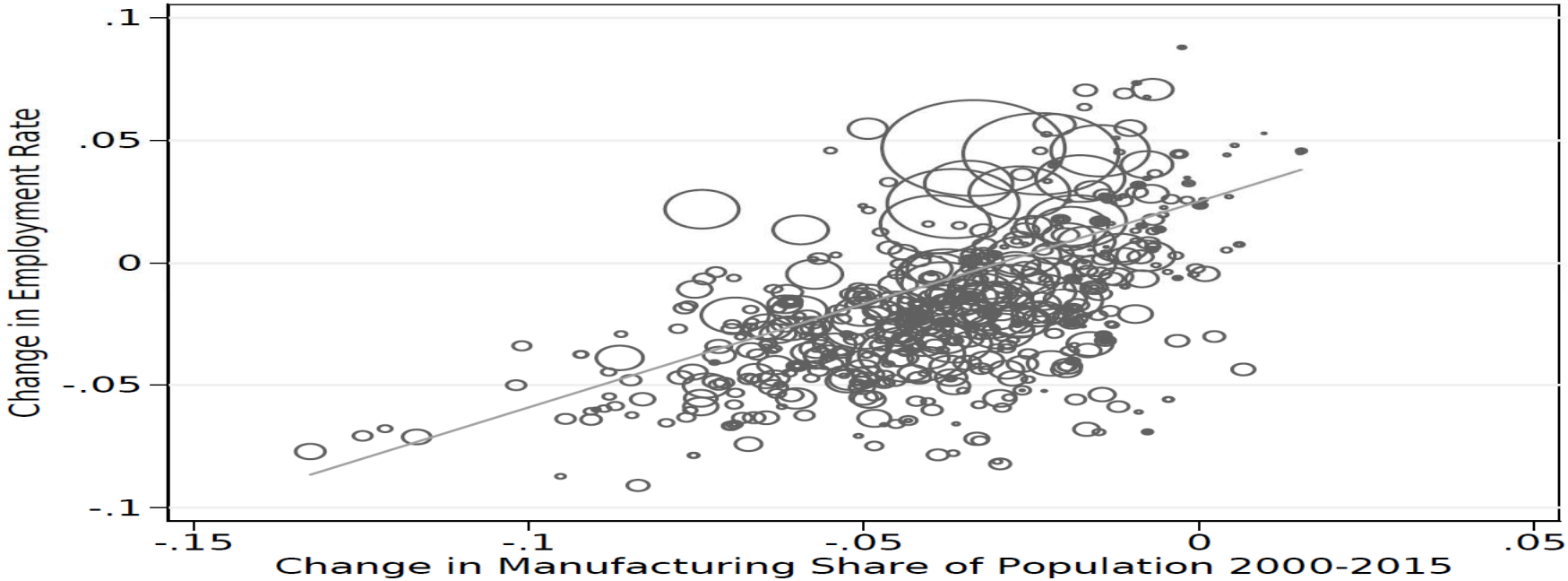
Can Cross-Region Variation Be Used to Learn About Manufacturing's Importance in Driving Employment Rate Decline?

Distribution of Manufacturing Activity in US in 2000



- Share of individuals 21-55 working in manufacturing (commuting zone)
- Commuting zone: area where most who live in that area work in that area.
- Darker red means more manufacturing in 2000

Change in Manufacturing Share vs Change in Employment Rate, Prime Age Men



- **Each circle is a commuting zone.**
- **Larger circles are larger commuting zones.**

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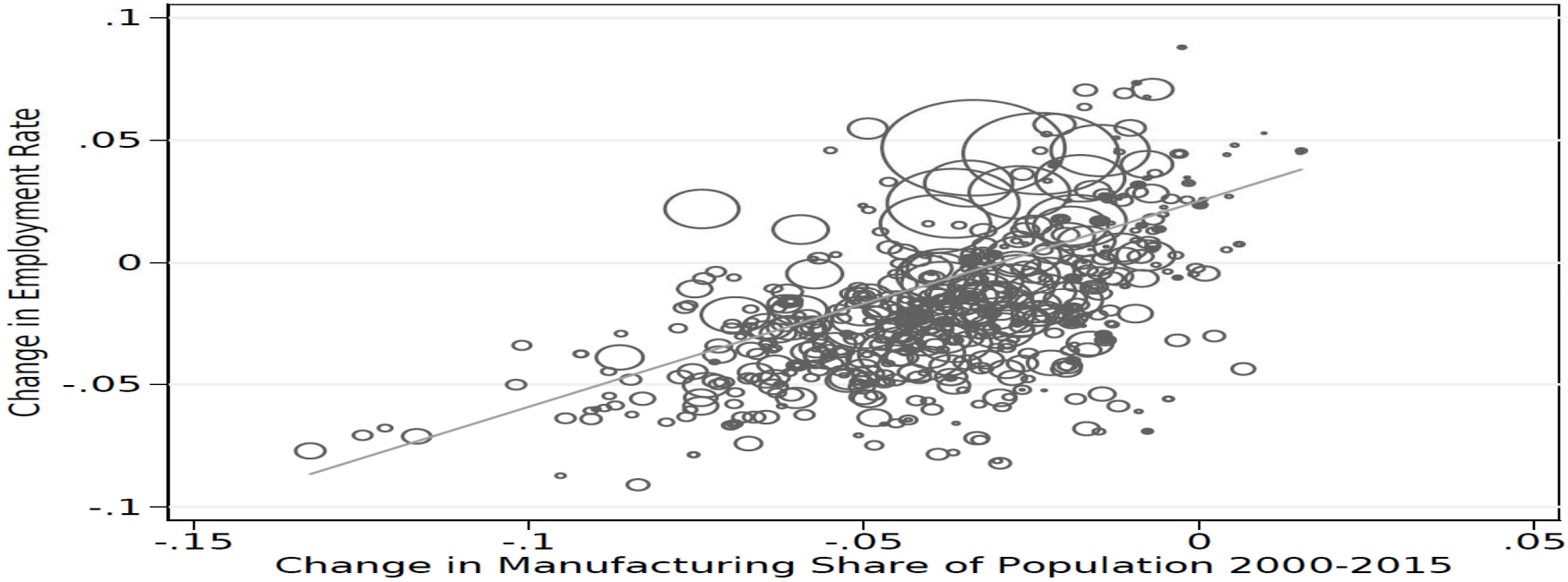
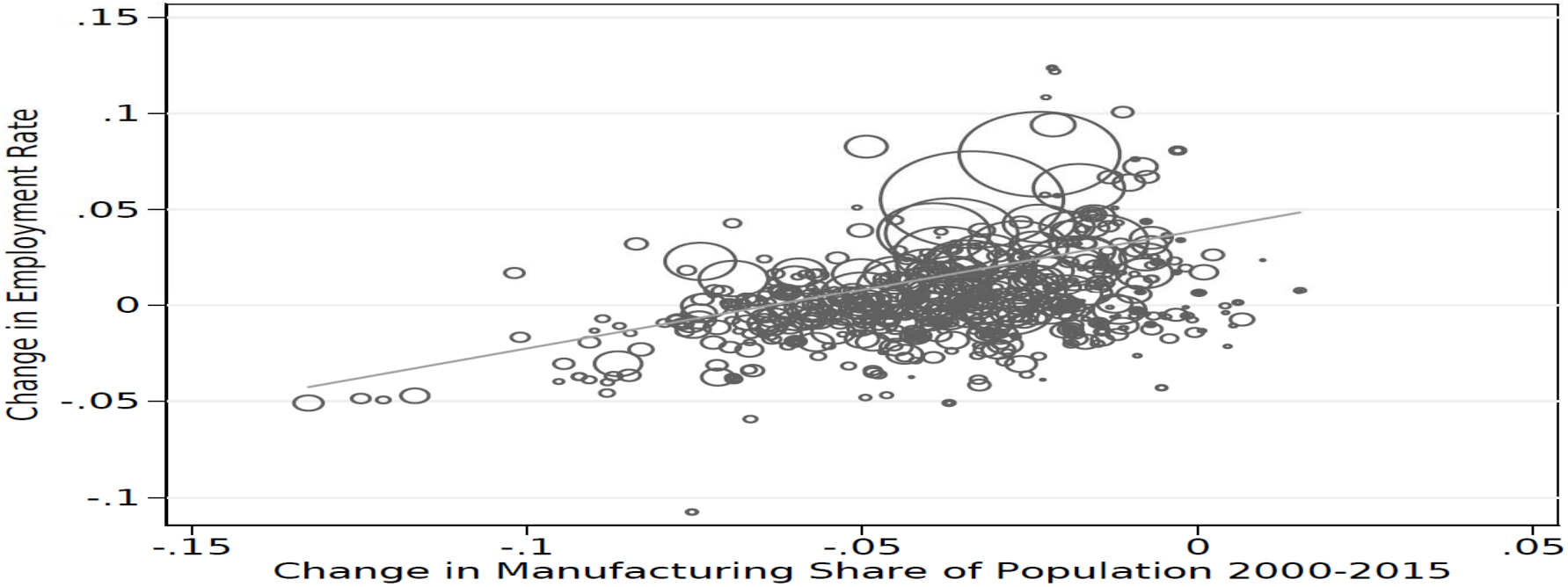


- **Take-Away: Commuting zone with larger decline in manufacturing had larger decline in male employment to population ratio (2000-2015)**

Change in Manufacturing Share vs Change in Employment Rate, Prime Age Women

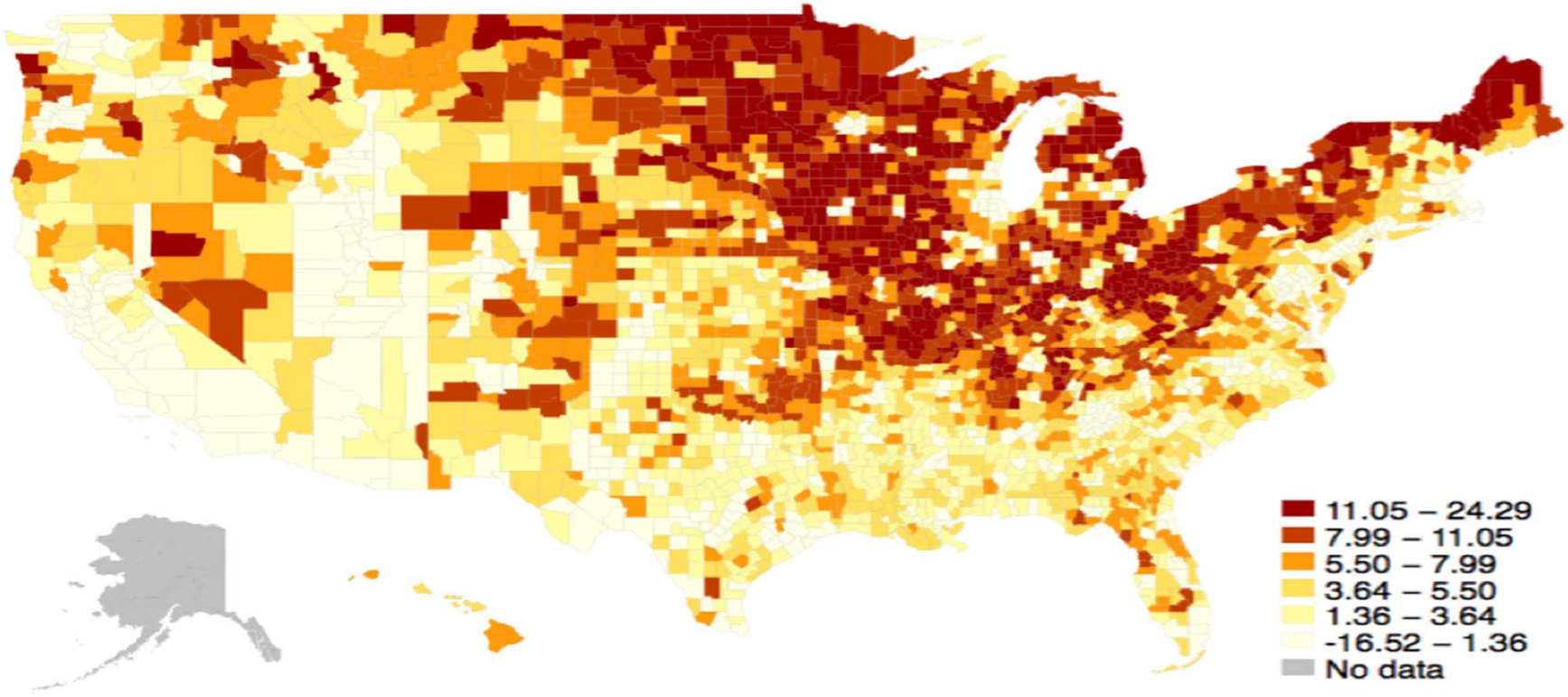


- **Take-Away: Commuting zone with larger decline in manufacturing had larger decline in female employment to population ratio (2000-2015)**

Question:

Is Manufacturing Decline Related to Recent Political Shifts

Shift towards Republican Presidential Voting 2016

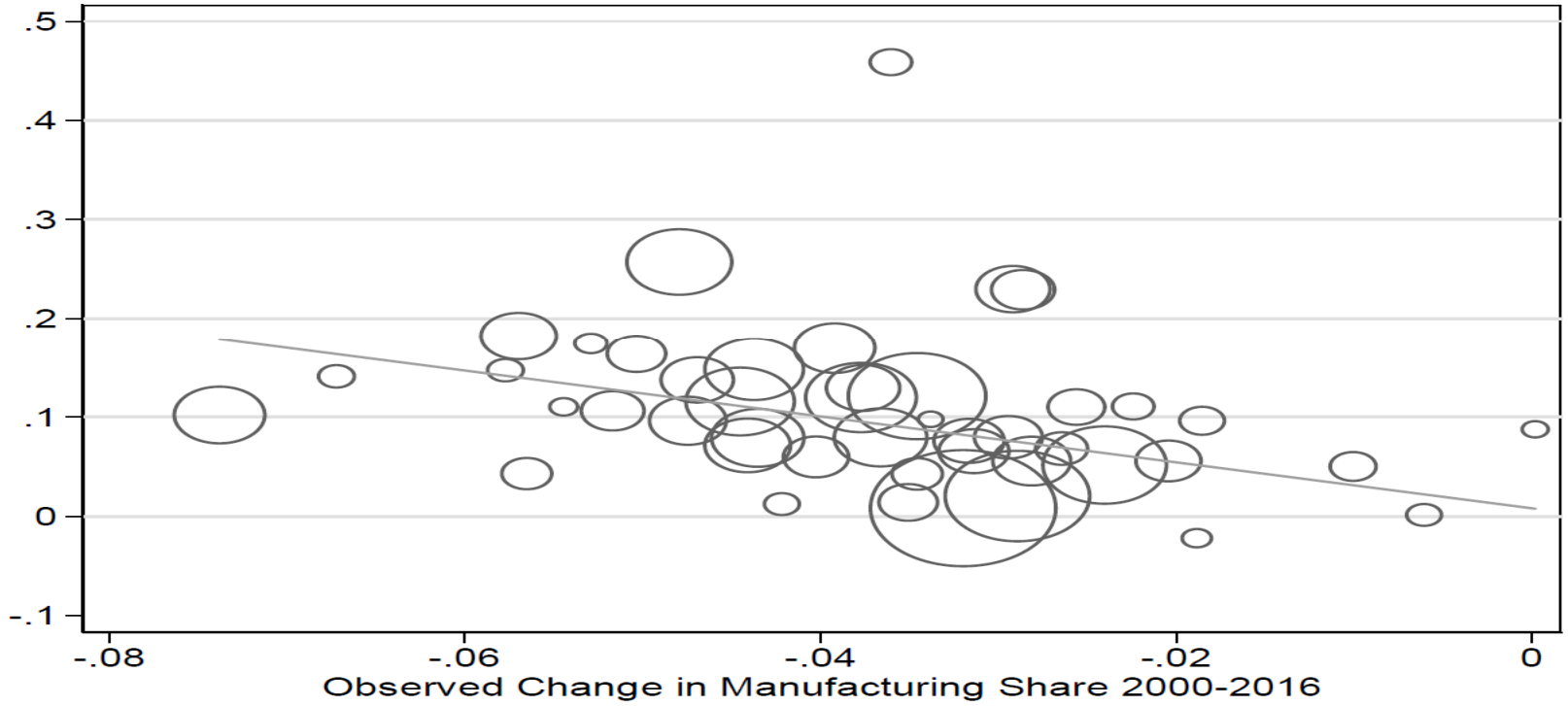


Vote Share Republican 2016 – Vote Share Republican 2012 (by county)

Question:

Is Manufacturing Decline Related to Increased Opioid Use?

Change in Manufacturing Share (State Level) vs Change in Per Capita Opioid Overdose Deaths (State Level)



Summary: Part 1

- **Technology has transformed the manufacturing sector**
- **Manufacturing is important because:**
  - It was a very large share of employment for less educated workers
  - It is very spatially concentrated
- **The technology revolution in manufacturing has reduced employment rates for primarily less educated workers (displacing workers).**
- **The skill intensity of manufacturing is increasing.**
- **Policies to promote the manufacturing sector WILL NOT substantively increase the employment rate for less educated workers.**

Part 2:

Broader Macroeconomic Implications of Technological Shifts

Have We Been Here Before?

- *"We are being afflicted with a new disease of which some readers may not have heard the name, but of which they will hear a great deal in the years to come, namely, technological unemployment"*

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  John Maynard Keynes, 1930

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  Wassily Leontief, 1952

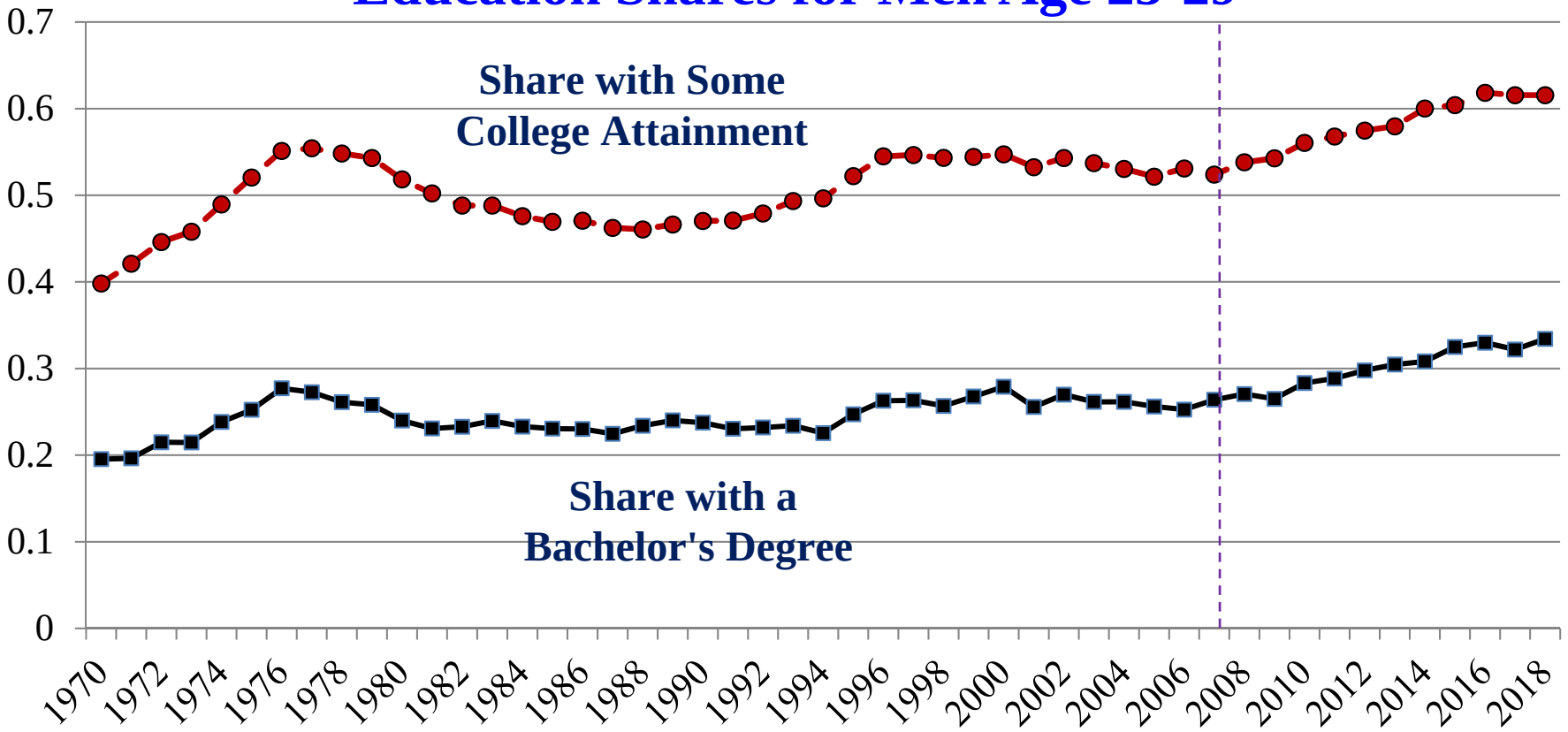
Transition from Agriculture

- In 1910, one third of all men in the U.S. worked in agriculture.
- Today, that number is about 3 percent.
- A “robot” automated agriculture – we called that robot a “tractor”.
- The U.S. economy weathered that structural change.
- Workers adjusted to the automation shock in the agriculture sector. New sectors grew as agriculture shrank.

How Do Labor Market Adjust to Technological Shocks?

- **Shocks are industry and location specific: workers can switch industries and locations.**
- **However, both switching industries and switching locations impose costs on workers.**
  - Workers may not have the skills for new industries
  - Workers may find it costly to move to new areas (loss of social networks)
- **Workers can also choose to accumulate more skills (go to college, go to training programs, etc.)**
  - Worker skill acquisition is also costly
- **These adjustments take time.**

Education Shares for Men Age 25-29



- **Until recently, education shares were flat for young men.**

Larger Labor Market Issue if Adjustment is Costly

- **Inequality**
  - Labor markets for lower to middle skilled workers much weaker than for higher skilled. Contributes to growing inequality.

Larger Labor Market Issue if Adjustment is Costly

- **Some Policy Responses That May Not Help Mitigate Employment Inequality**
  - **Corporate tax cuts**: Tax policy may spur firm investment. Will that new capital complement or replace workers?
  - **Trade policy**: Protecting U.S. manufacturing will not bring back U.S. manufacturing jobs – hard to undo automation.
  - **Universal basic income**: May slow down adjustments further (income effect on labor supply). Expensive policy for potentially small effects on employment.

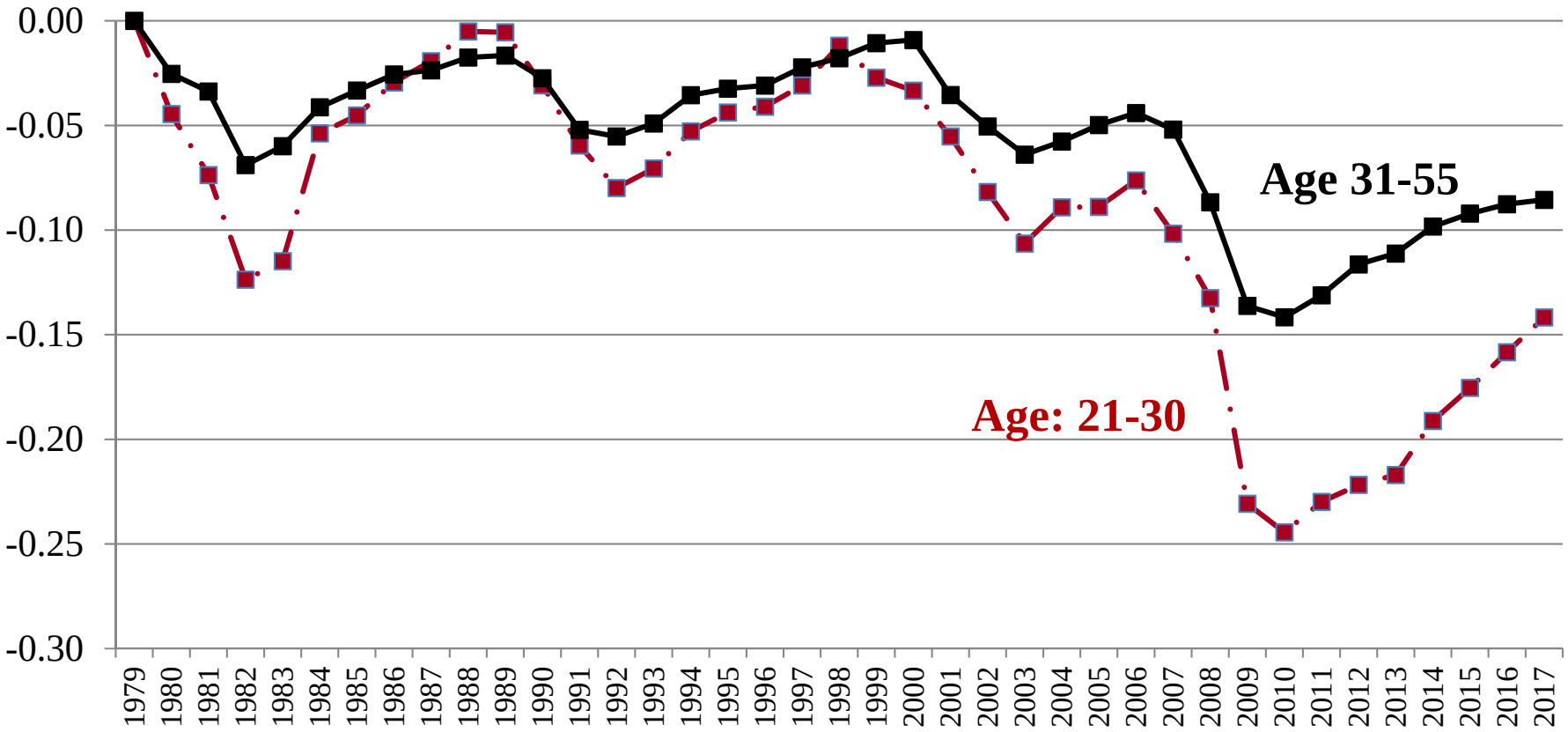
Larger Labor Market Issues if Adjustment is Costly

- **Some Policy Responses That May Help Mitigate Employment Inequality**
  - **Earned Income Tax Credit**: Subsidized small amounts of working relative to not working at all.
  - **Tax subsidized apprenticeships**: German model. Provide incentives for manufacturing sector to train workers for needed skills.
  - **Rethinking high school education**: Providing the choice of some vocational training in high school.
- **Want policies to that reduce worker costs of adjustment (e.g., costs associated with moving sectors, moving locations, or acquiring skills).**

Part 3:

Technology and Labor Supply

Annual Hours Worked, Male



A Broad Theory of Labor Supply

- **When deciding when to work, an individual worker compares the value of working (e.g., market wage) to the value of not working (e.g., the reservation wage).**
  - Technology can affect the market wage (shifts in labor demand)
  - Technology can affect the reservation wage (shifts in labor supply)

- **In the past, market wages and reservation wages may have trended similarly.**

- **Now, technology is reducing market wage for less educated workers.**

- **Can technology now be increasing reservation wage for young workers?**

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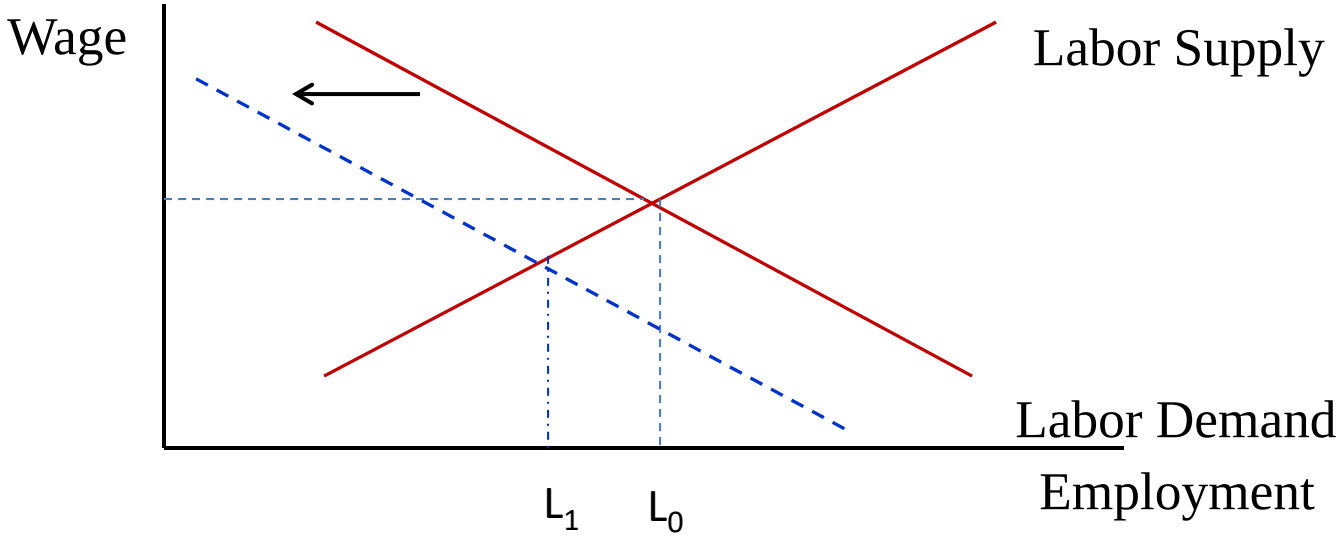

- **Only labor demand falls:**
  - Employment and wages fall

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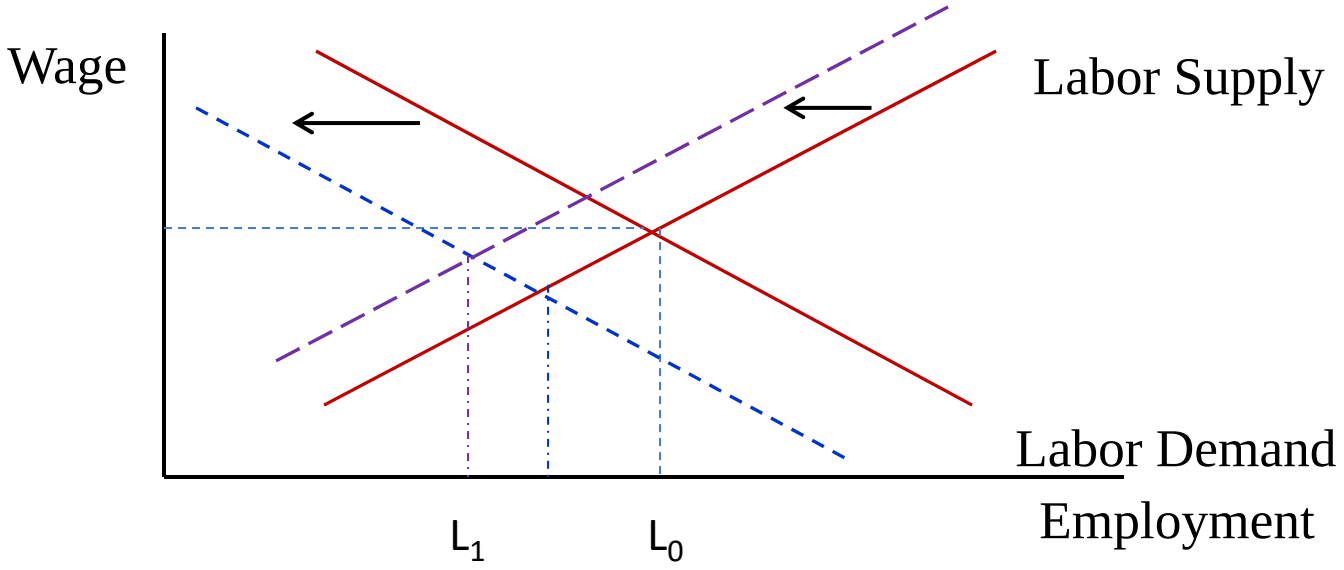

- **Both labor demand and labor supply**
  - Employment falls more and wages fall less (may increase)

Major Recent Innovations in Computer Leisure Technology

- Able to engage in leisure activities easily with others at different locations.
- **Social media** – Facebook started in 2004; grew from 12 million to 360 million users between 2006 and 2009.
- **Video games** – Sony, Microsoft and Nintendo all released consoles in 2005/2006 that allowed online capabilities. Video game revenues increased by 50 percent 2006-2009 (were flat between 2000 and 2006).
- **Large multiplayer online video games** developed over same time period. World of Warcraft started around 2005 and had 10 million monthly users by 2009.
- **iPhone** released in 2007. Smart phones take off.

Hours per Week of Leisure Time From Time Use Surveys, Young Men (Age 21-30)

	Men 21-30		
	Pooled 2004-2007 ATUS		Pooled 2012-2015 ATUS
Total Leisure	**61.1**	**+2.5**	**63.6**
Adj. Eating/Sleeping/P. Care	24.3		24.9
Total Computer Time	**3.3**	**+1.9**	**5.2**
(Video Game Sub Component)	**(2.0)**	**(+1.4)**	**(3.4)**
TV	17.3		17.2
Socializing	7.8		8.0
Other Leisure	8.3		8.2

Take Away: Computer time went up by 100 hours per year from 2004-2015

Time Use (Hours/Week) from ATUS, By Sex-Age-Skill Group

	(1) Pooled 2004-2007	(2) Pooled 2012-2015	(3) Diff (2)-(1)
Men, 31-55, Ed = All			
Total Leisure	57.0	58.1	1.1
Total Computer	2.1	2.2	0.1
Video Games Sub Component	(0.9)	(0.8)	(-0.1)
Women, 21-30, Ed = All			
Total Leisure	58.4	60.0	1.6
Total Computer	1.5	2.2	0.7
Video Games Sub Component	(0.8)	(0.8)	(0.0)
Women, 31-55, Ed = All			
Total Leisure	56.1	58.0	1.9
Total Computer	1.6	2.1	0.5
Video Games Sub Component	(0.6)	(0.7)	(0.1)

U.S. Cohabitation With Parent or Close Relative, US Census Data

	21-30 Year Olds, All Education Groups	
	Men	Women
2000	0.30	0.20
2007	0.35	0.26
2010	0.39	0.29
2014	0.44	0.33
Change 00-14	0.14	**0.13**

U.S. Cohabitation Patterns By Employment Status, Men 21-30, Census Data

	Pooled 2012-2015 Data	
	Employed	Non-Employed
Living w/Parent or Close Rel.	0.37	**0.67**
Head: Single	0.23	**0.12**
Head: Spouse/Partner	0.28	**0.12**
Living w/ Others	0.12	**0.09**

Trends in Self Reported Happiness

- **Data from General Social Survey (GSS)**
- **Look at fraction self-reporting “pretty happy” or “very happy”**
- **Change between 2001/05 and 2011/15**

Younger Men (21-30)	
Ed = All	+5.3 p.p
Ed < 16	+6.8 p.p.
Older Men (31-55)	
Ed = All	-3.9 p.p.
Ed < 16	-6.9 p.p.

Summary: Technology's Impact on Labor Market

- **Technology had an effect on labor demand.**
  - Sectoral decline in manufacturing
  - Effects concentrated on those lower levels of education
- **Technology may have also had an effect on labor supply**
  - Makes leisure more attractive
  - Raises the reservation wage
  - Effects concentrated on the young (particularly young men)
- **Policies should mitigate barriers to labor market adjustments.**

Questions and Discussion