

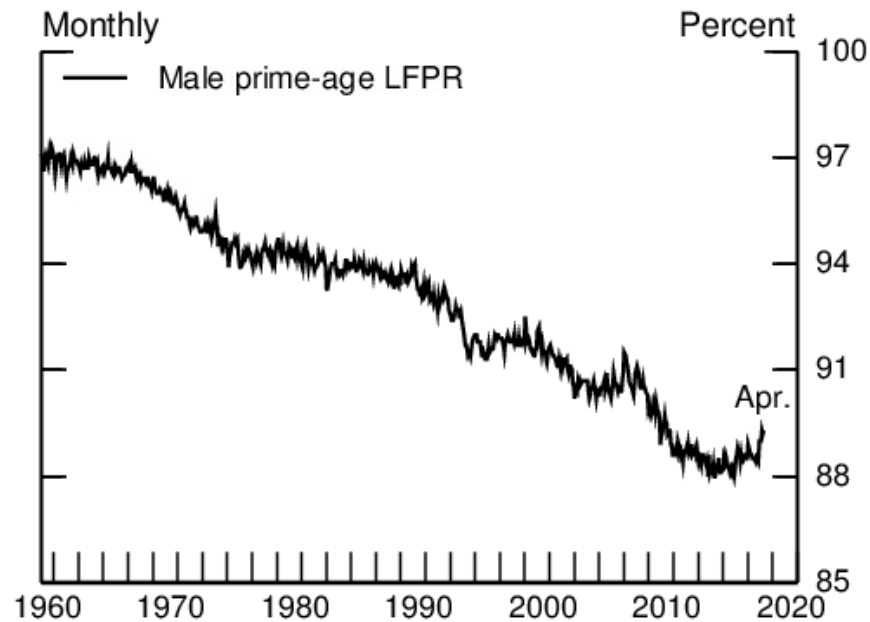
Technology, Productivity, and Labor Market Outcomes in the United States

**Where are we (and where are we not)
seeing the effects of technology?**

**Bill Wascher
Federal Reserve Board**

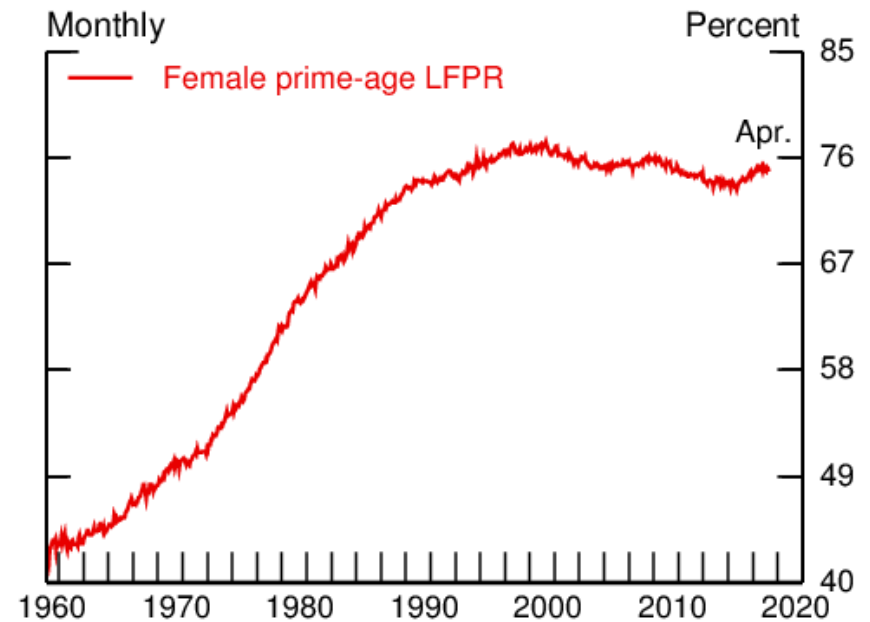
Labor Market Outcomes

Prime-age labor force participation rates



Note: LFPR is labor force participation rate.

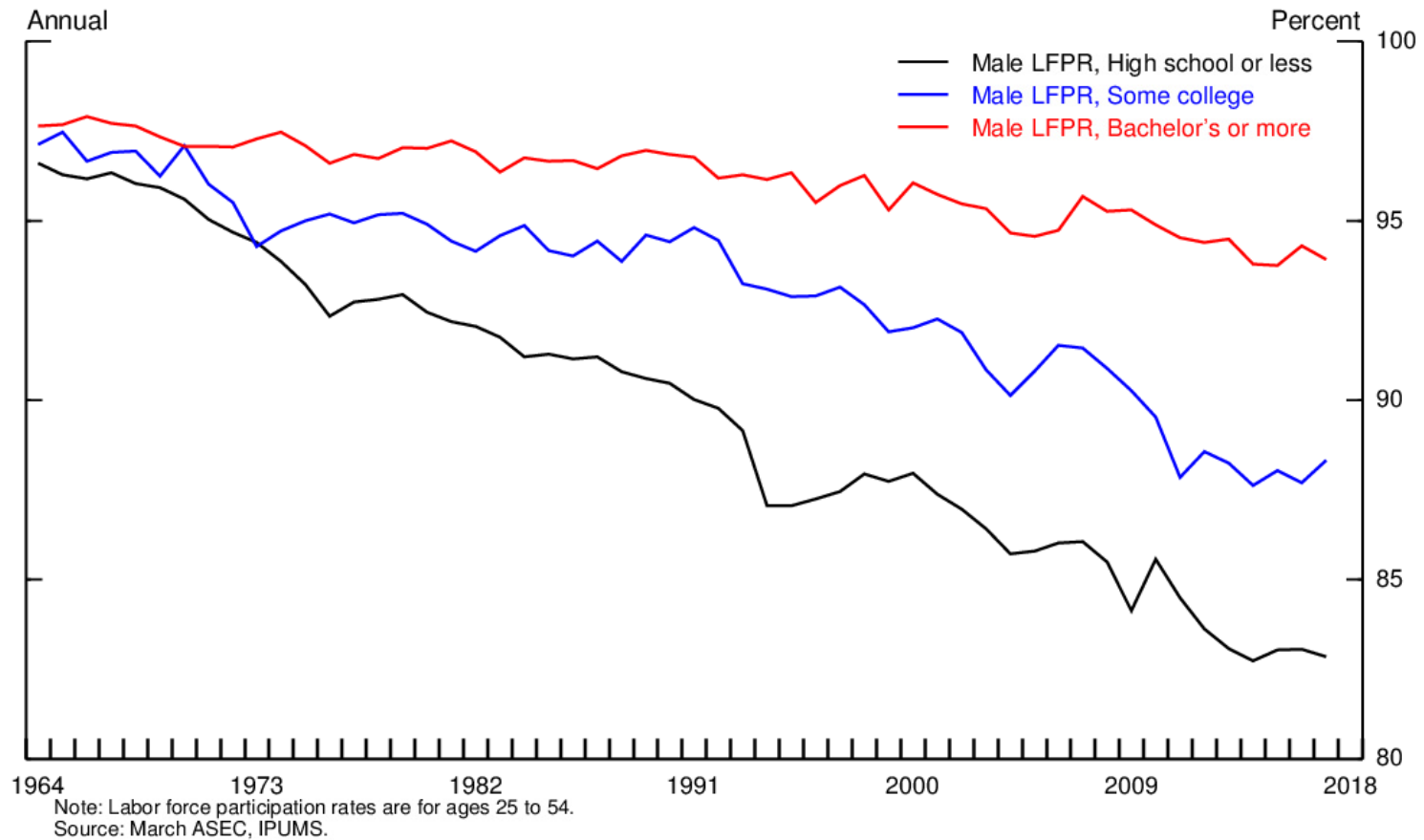
Source: U.S. Department of Labor, Bureau of Labor Statistics.



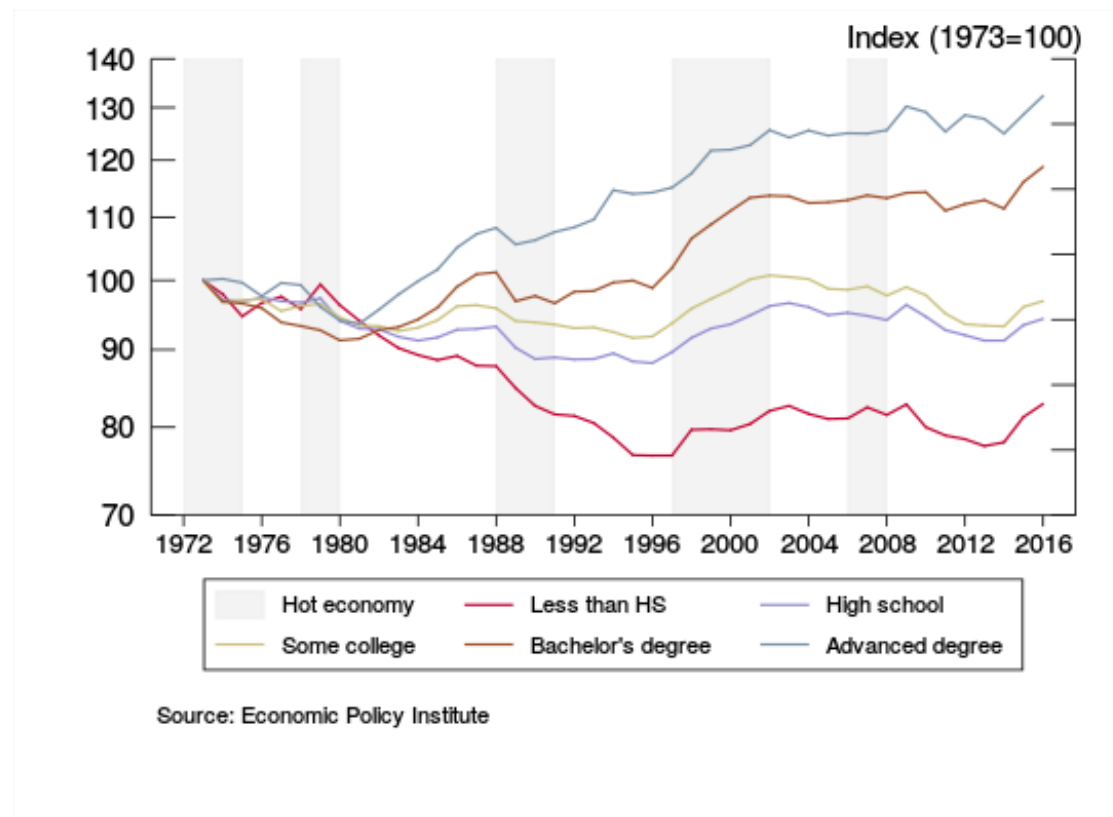
Note: LFPR is labor force participation rate.

Source: U.S. Department of Labor, Bureau of Labor Statistics.

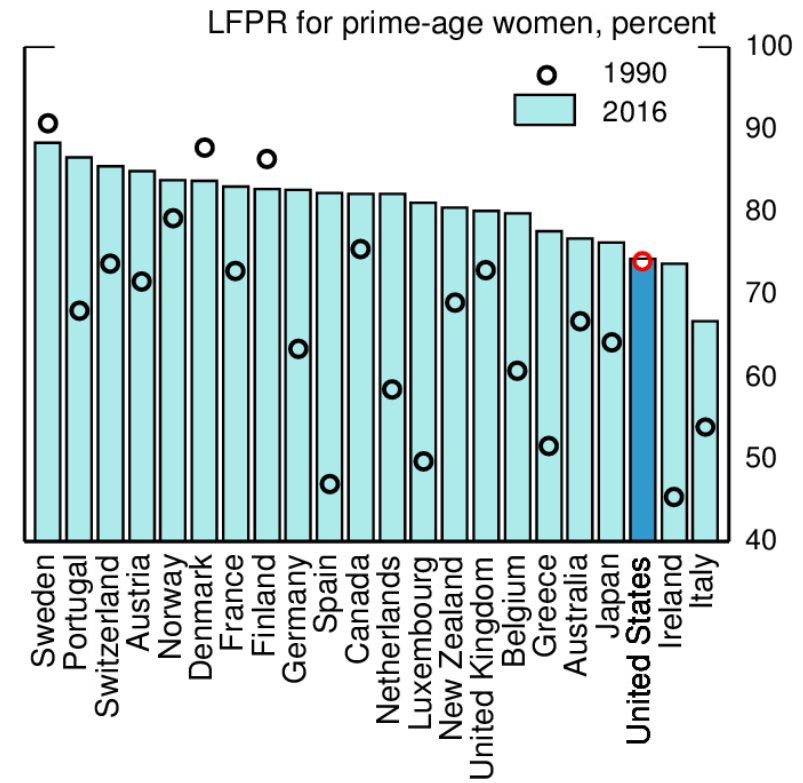
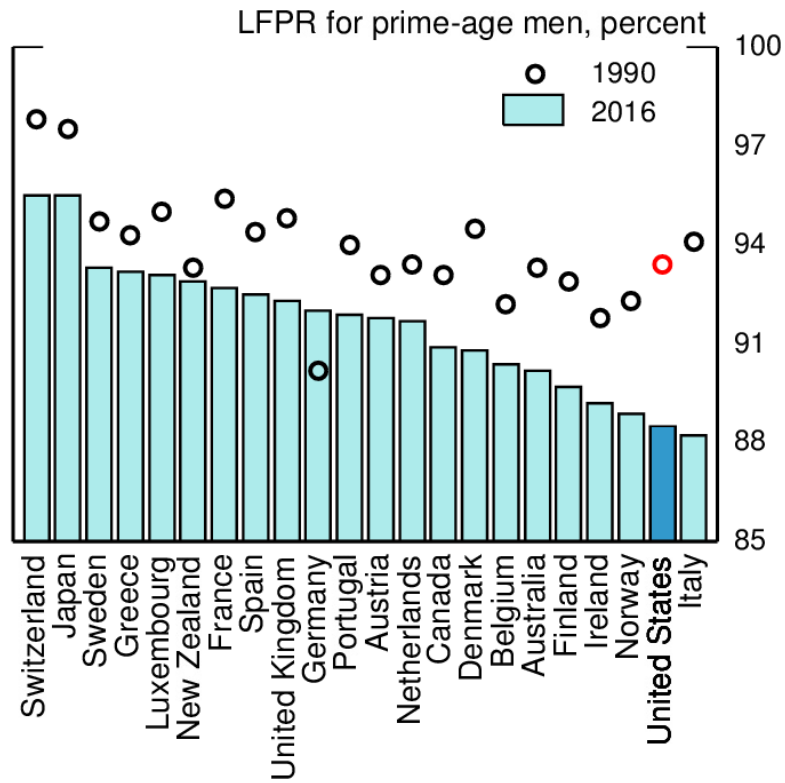
Male labor force participation rate by level of educ. attainment



Wages by level of educational attainment



Changes in LFPRs Across Countries



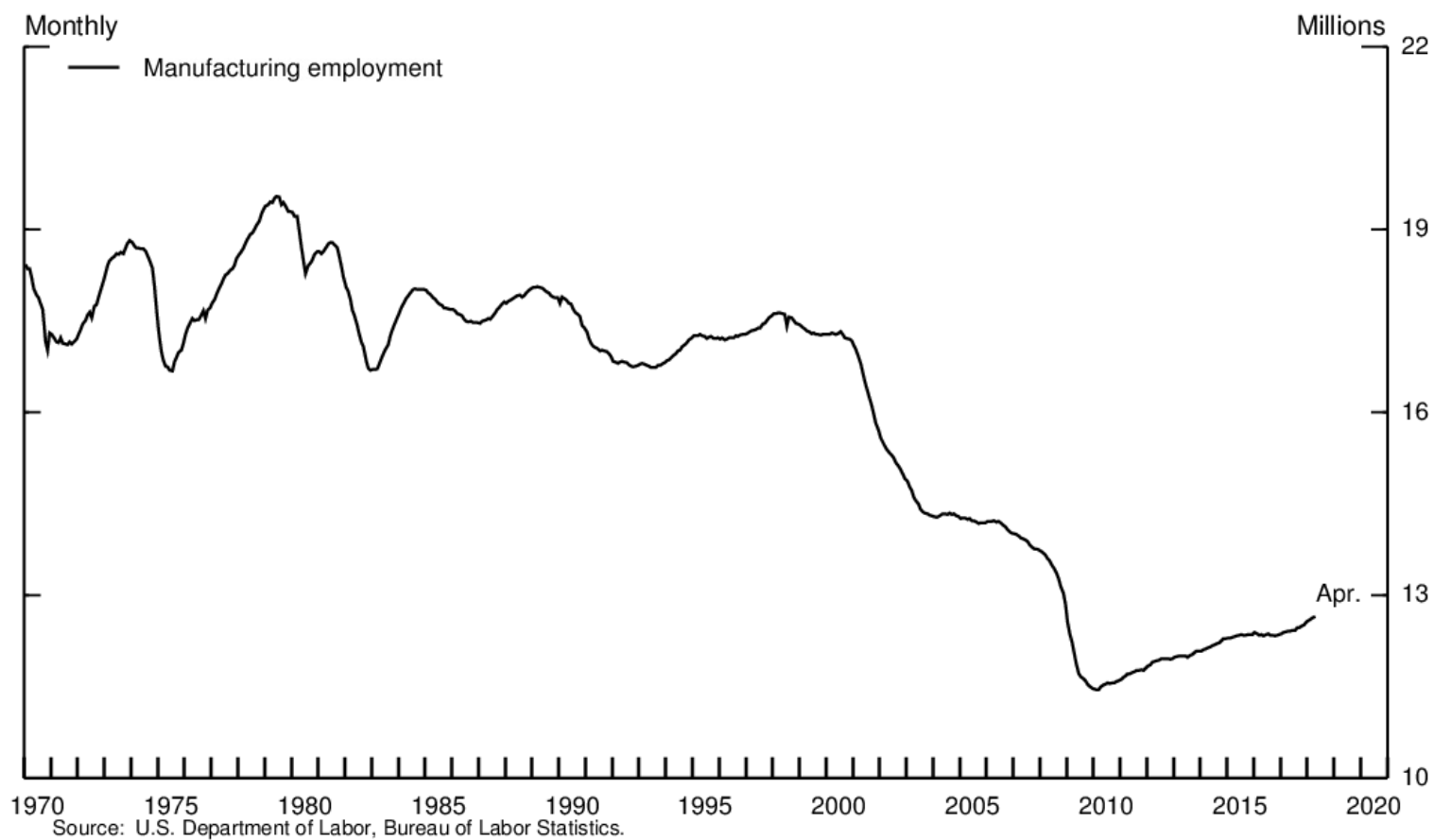
Note: For Austria, the 1990 data refer to 1994; for Switzerland, the 1990 data refer to 1991.

Source: Organisation for Economic Co-operation and Development.

Contributing Factors

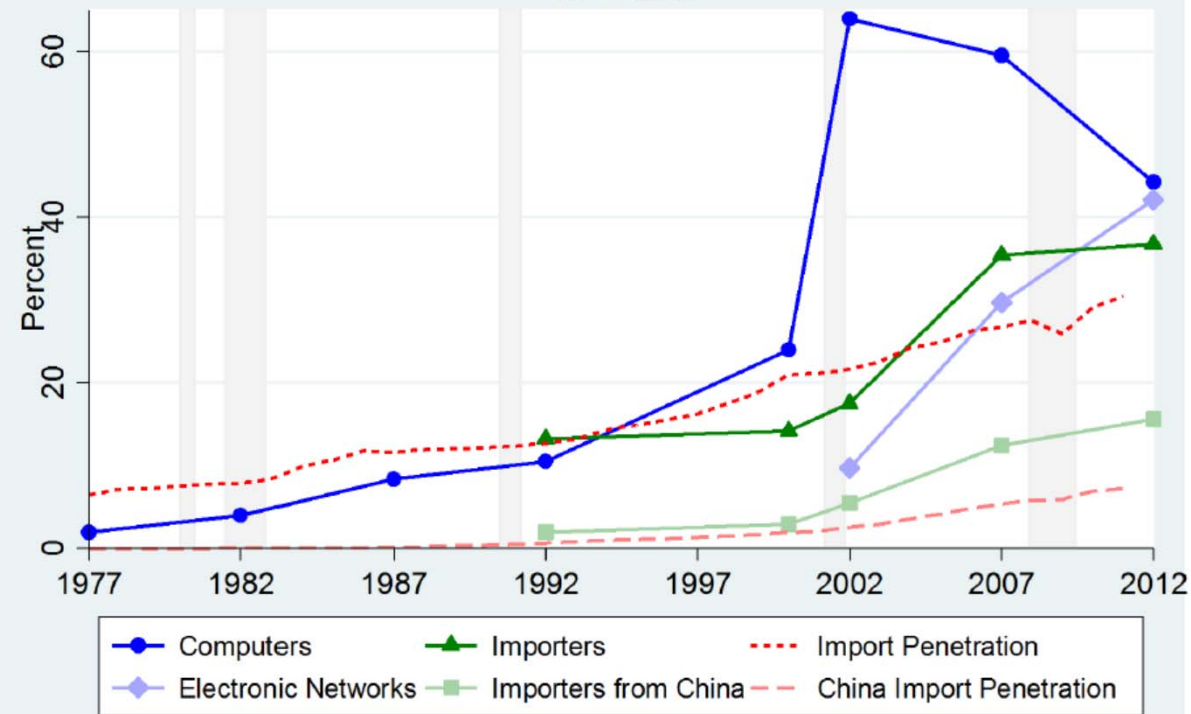
- Demand side
 - Technology: Increasing output and falling employment
 - Trade: Falling output and employment
- Evidence for manufacturing (Fort, Pierce, and Schott, 2018; Flaan, forthcoming)

Manufacturing Employment

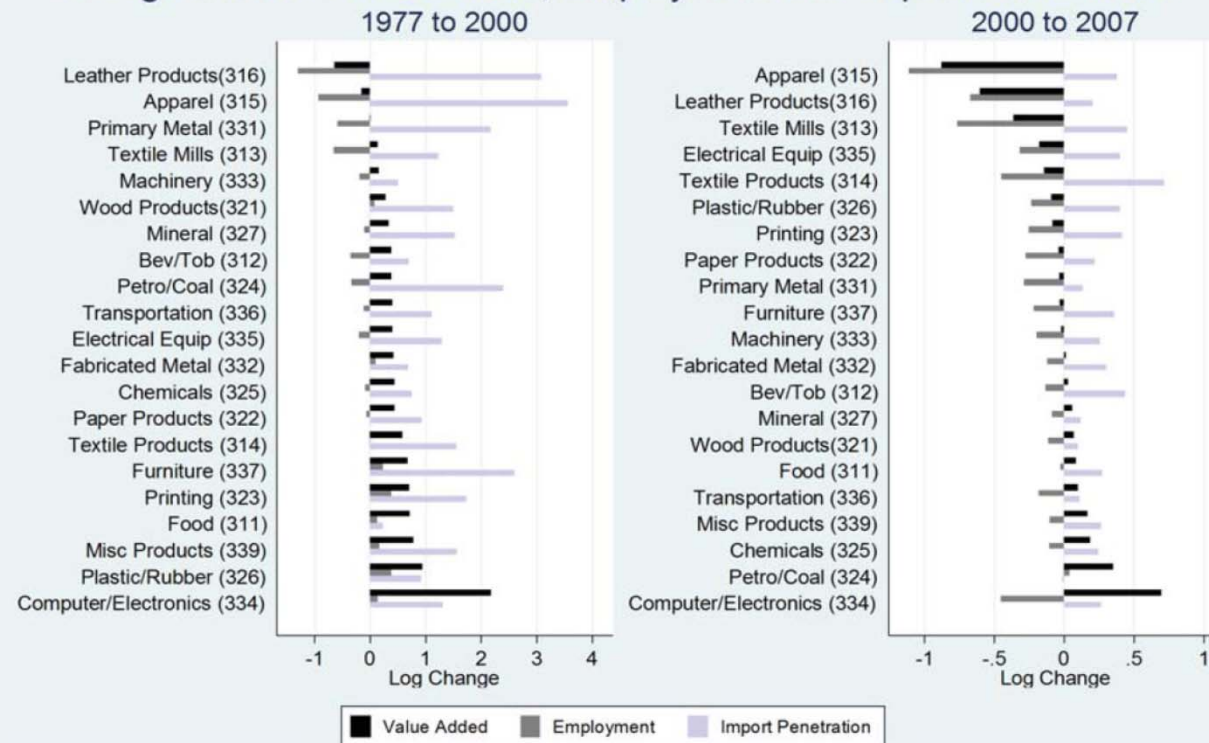


Importing and Technology Adoption

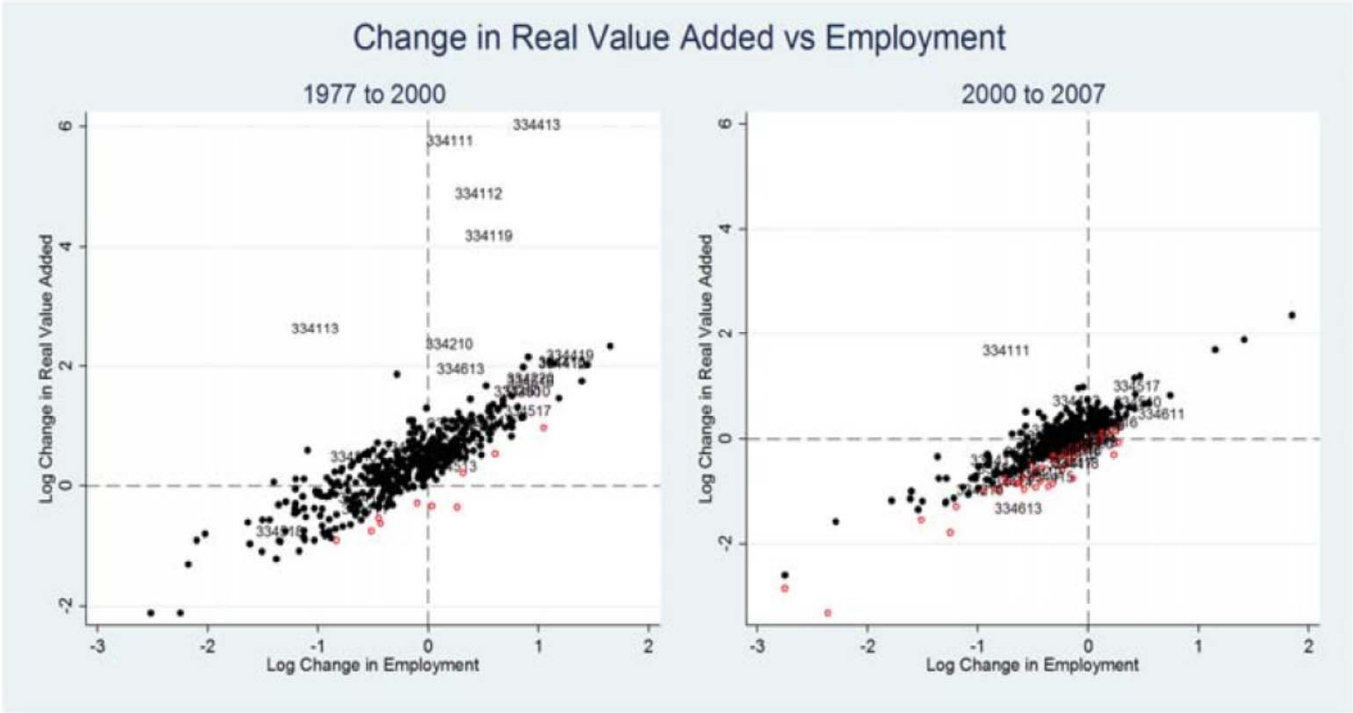
1977-2012



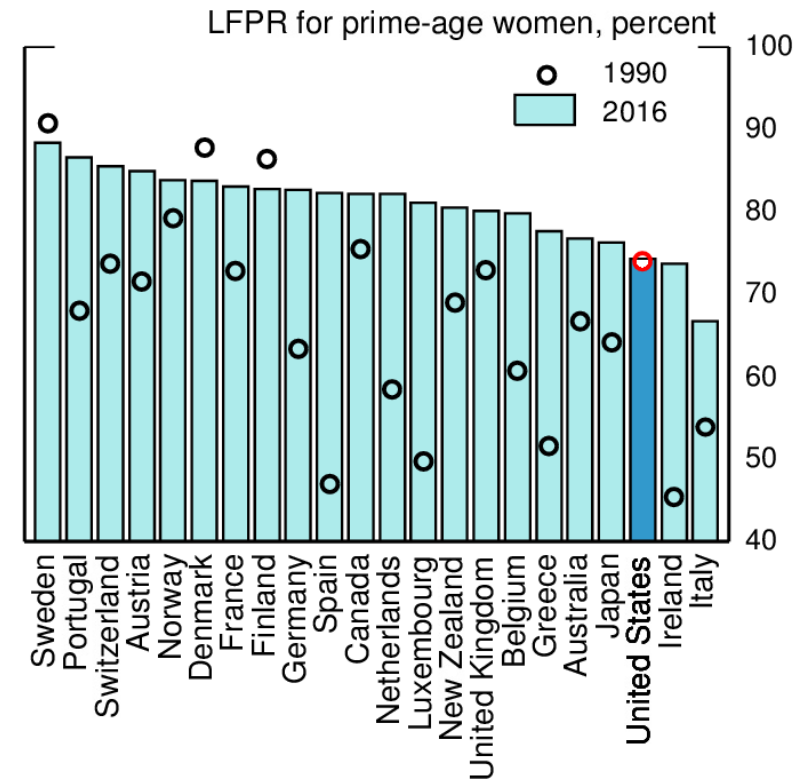
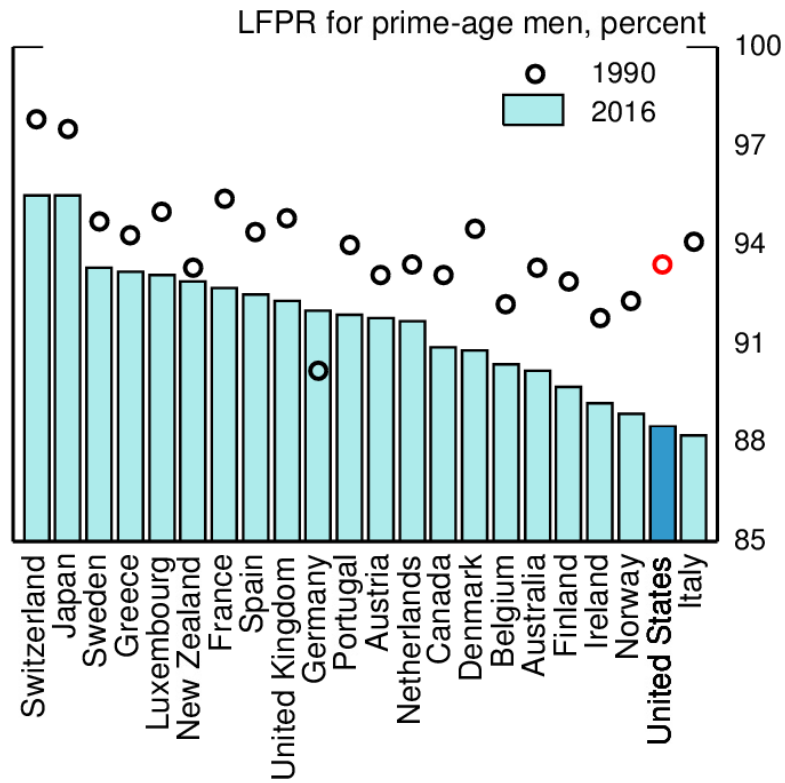
Change in Real Value Added, Employment and Import Penetration



Change in Real Value Added vs Employment



Changes in LFPRs Across Countries



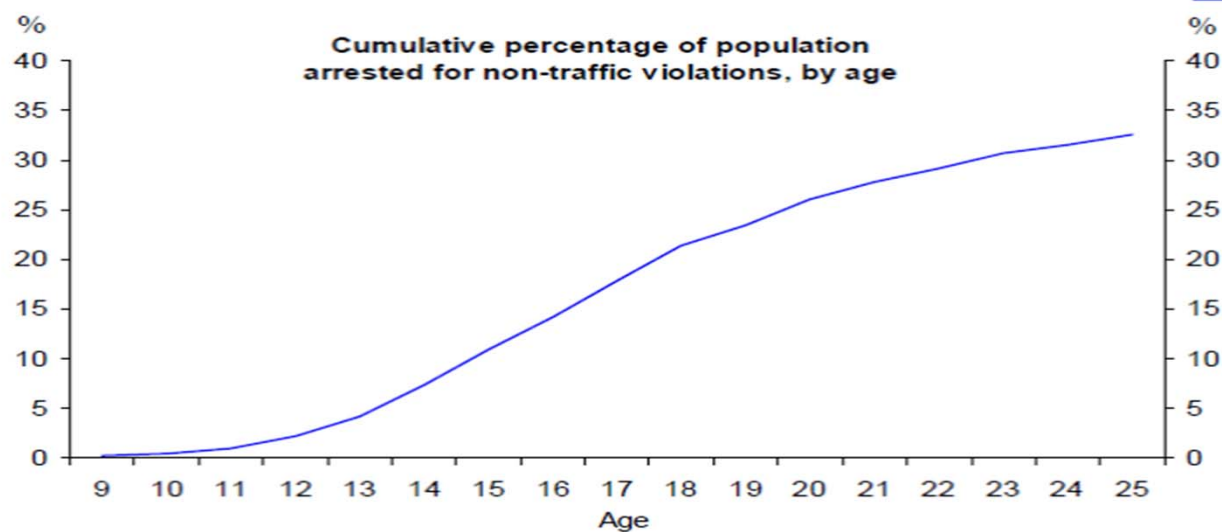
Note: For Austria, the 1990 data refer to 1994; for Switzerland, the 1990 data refer to 1991.

Source: Organisation for Economic Co-operation and Development.

Contributing Factors

- Demand side
 - Trade: Falling output and employment
 - Technology: Increasing output and falling employment
- Supply side
 - Changes in family labor supply
 - Disability insurance
 - Criminal records
 - Opioid crisis
 - Video games

1 in 3 Americans arrested by age 25

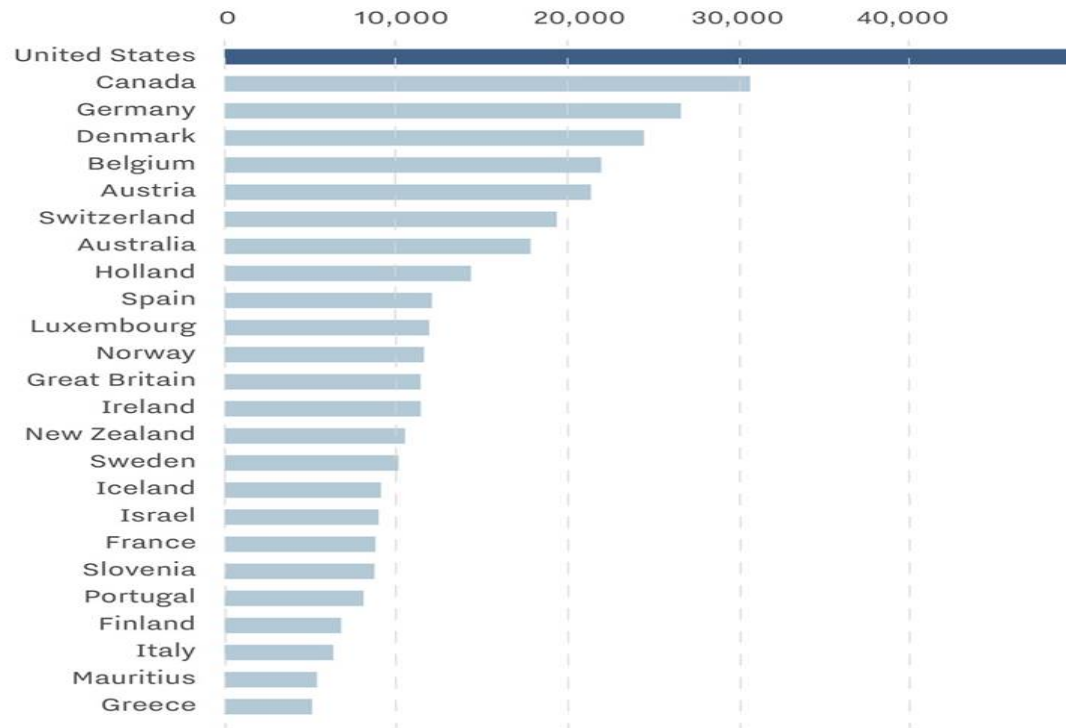


Note: Latest data is from 2015. Cumulative percentage calculated using the National Longitudinal Survey of Youth 1997.

Source: Justin Weidner, NLSY97, DB Global Markets Research

Americans consume more opioids than any other country

Standard daily opioid dose for every 1 million people

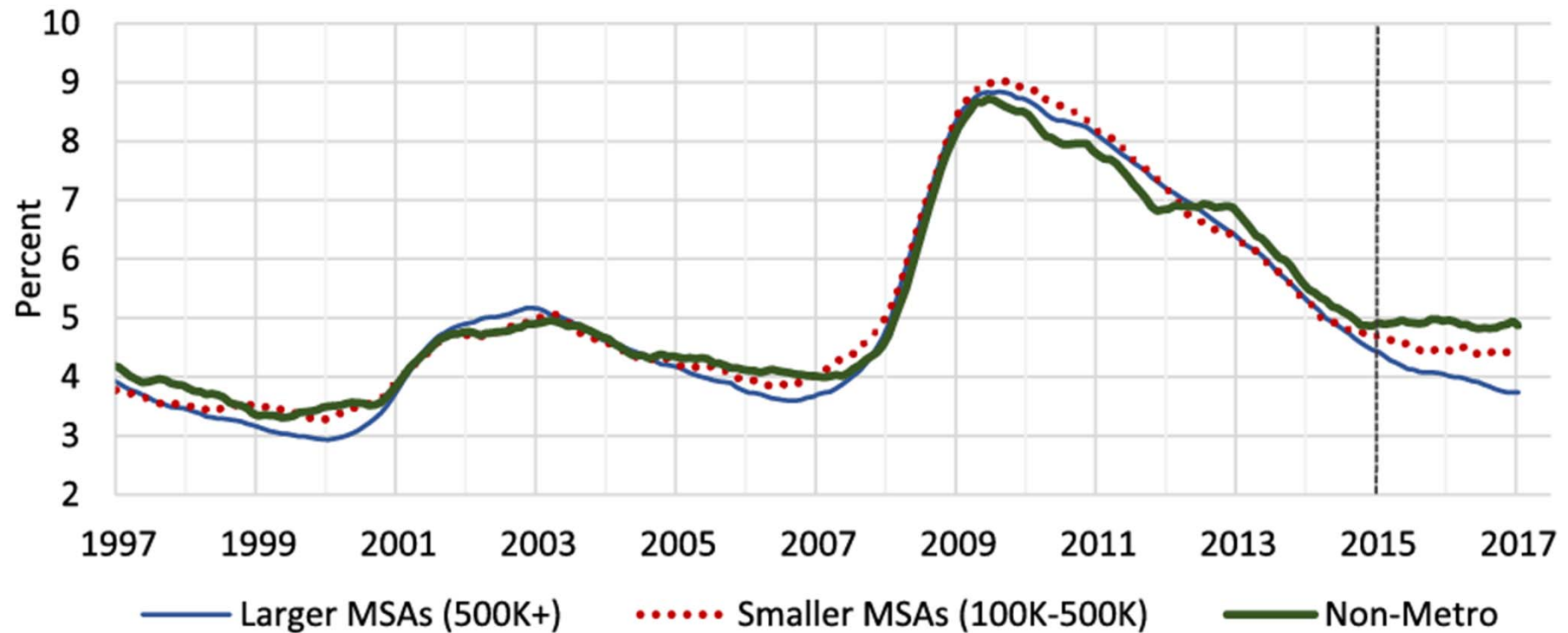


Source: United Nations International Narcotics Control Board

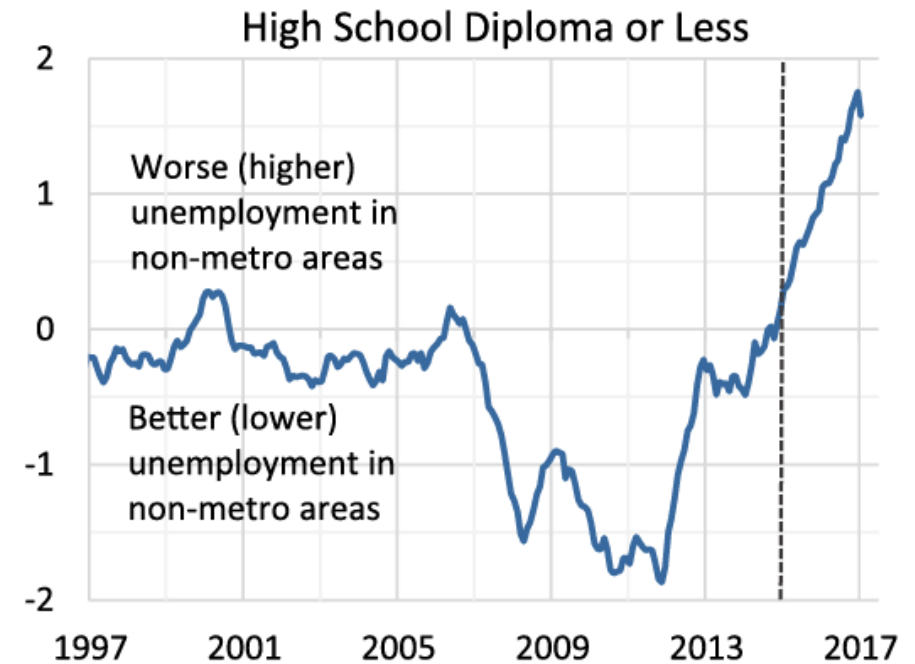
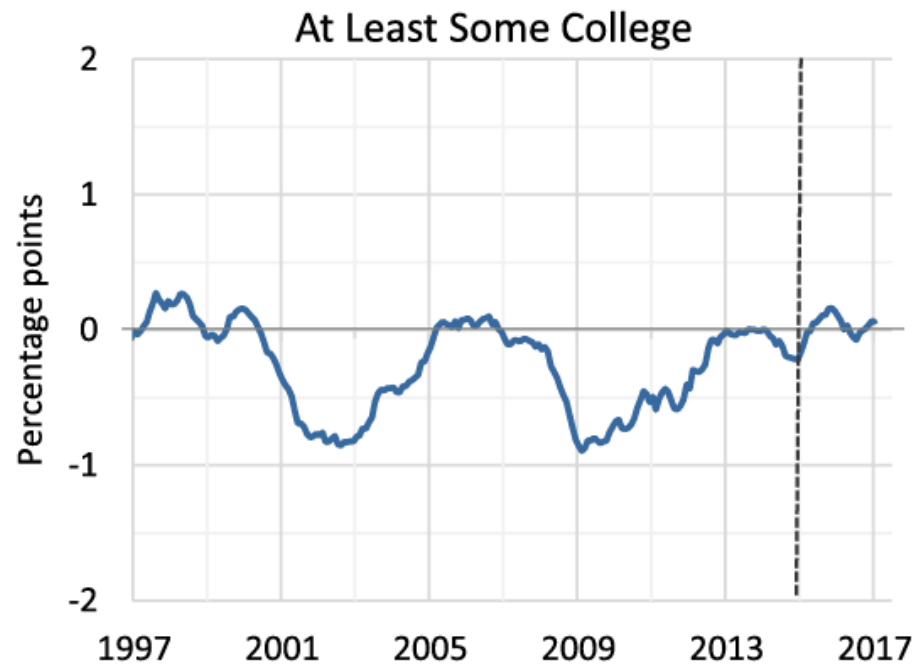
Credit: Sarah Frostenson

Vox

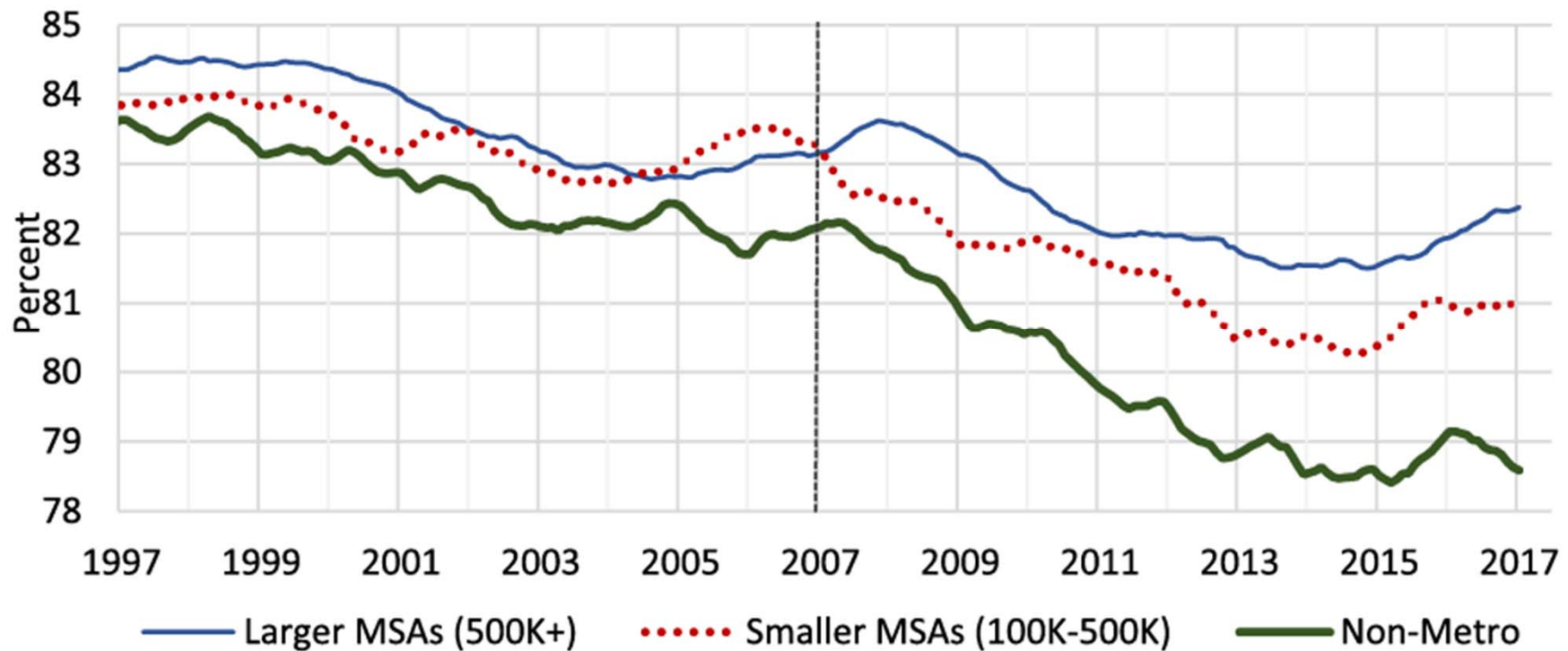
Prime-Age Unemployment Rates by Metropolitan Status



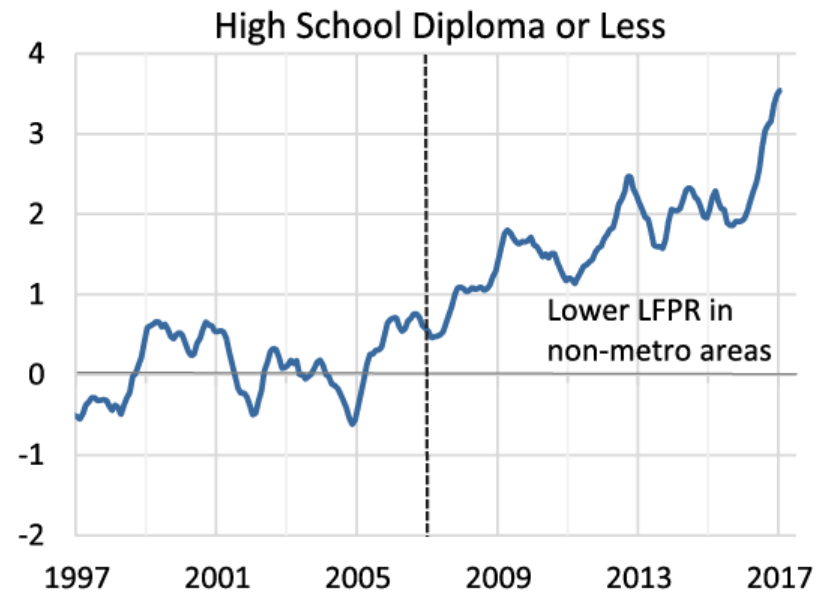
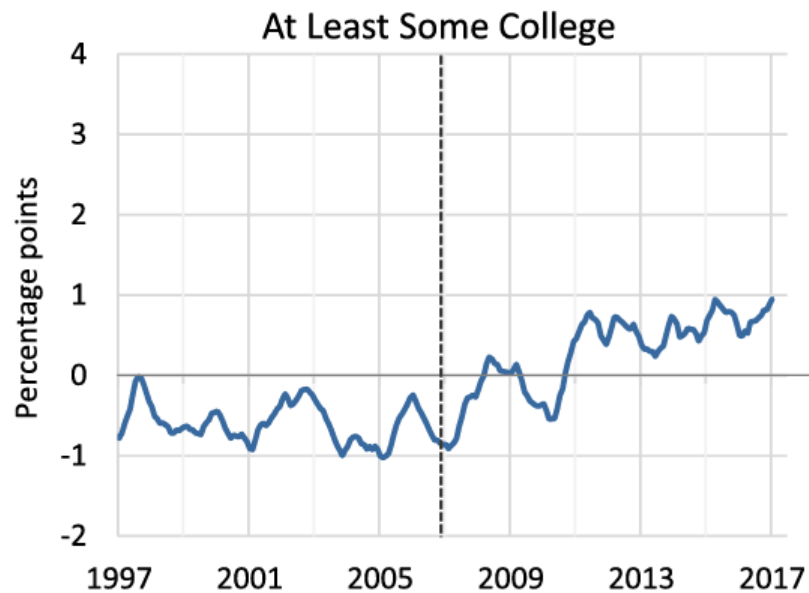
Unemployment Rate Gap (Non-Metro Minus Metropolitan Unemployment) by Education



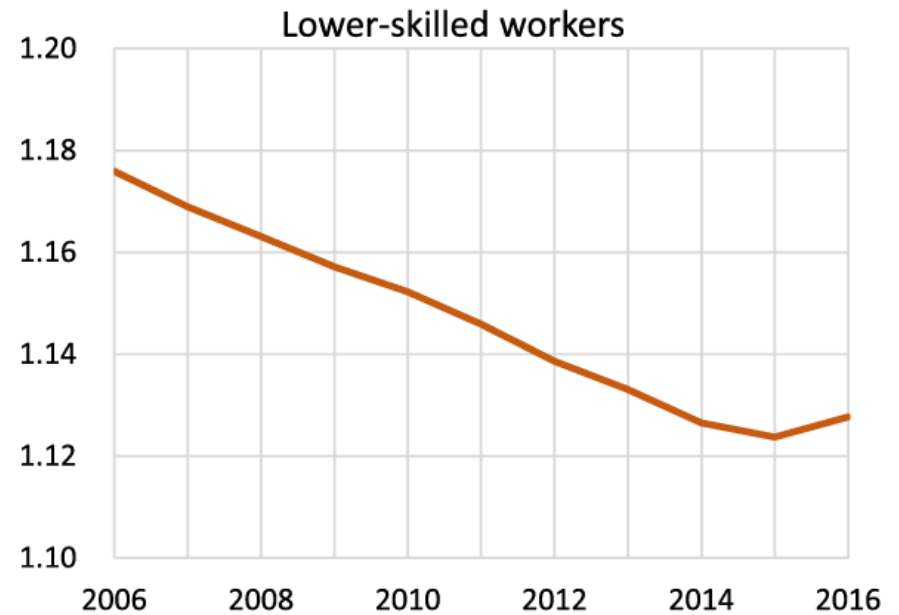
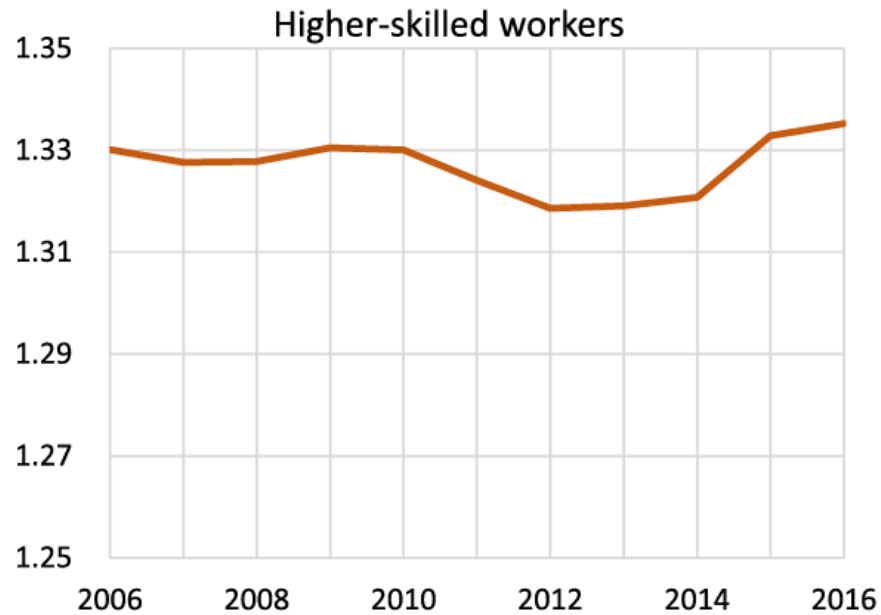
Prime-Age LFPR by Metropolitan Status



LFPR Gap (Metropolitan Minus Non-Metro LFPR) by Education



Ratio of Metropolitan to Non-Metropolitan Average Wages, by Skill



The Gig Economy

The Changing Work Ecosystem

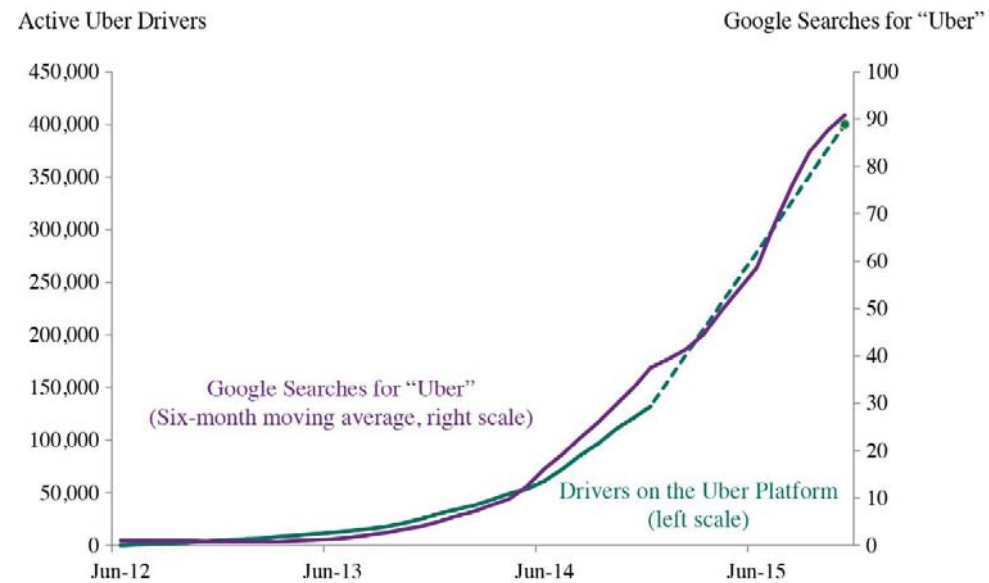
FIGURE 3. INDEXED NUMBER OF TAX FORMS, 1994–2014



Note: The vertical axis does not begin at zero.
Source: Authors' calculations of IRS data.

Source: Dourado and Koopman, "Evaluating the Growth of the 1099 Workforce," Mercatus Center, George Mason University, December 2015

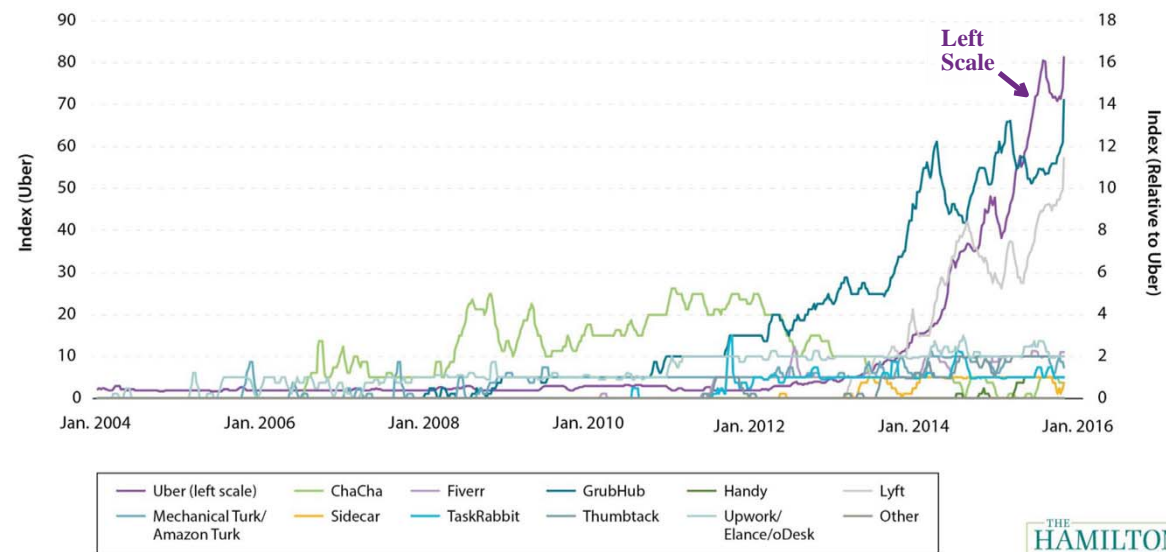
Number of Uber Drivers Has Grown Exponentially



Source: Cramer (2015), Hall and Krueger (2015), <https://newsroom.uber.com/2015/11/1776/>.

FIGURE 1.

Google Trends: Four-Week Moving Average of Web Searches



Source: Google Trends analysis by authors.

Notes: "Other" includes agentanything, axiom law, clickworker, Eden McCallum, Gengo, Gocurb/TaxiMagic, hourly nerd, Instacart, mediacast, Red Beacon, Samasource, Shyp, Skillshare, trycaviar/caviar delivery, and Washio. Search period spans January 1, 2015- November 7, 2015. Google Trends normalizes the data for each term specified relative to the total number of Google searches conducted in that week, so that the time period with the most searches for Uber equals 100.



Survey of Enterprising and Informal Work Activities (EIWA)

Community Development and
Consumer & Community Development Research
Division of Consumer & Community Affairs

The analysis and conclusions set forth in this presentation are our own and do not indicate concurrence of the Federal Reserve Board, the Federal Reserve Banks, or their staff.

Selling New/Used Goods is the Most Common Online E&I Work Activity

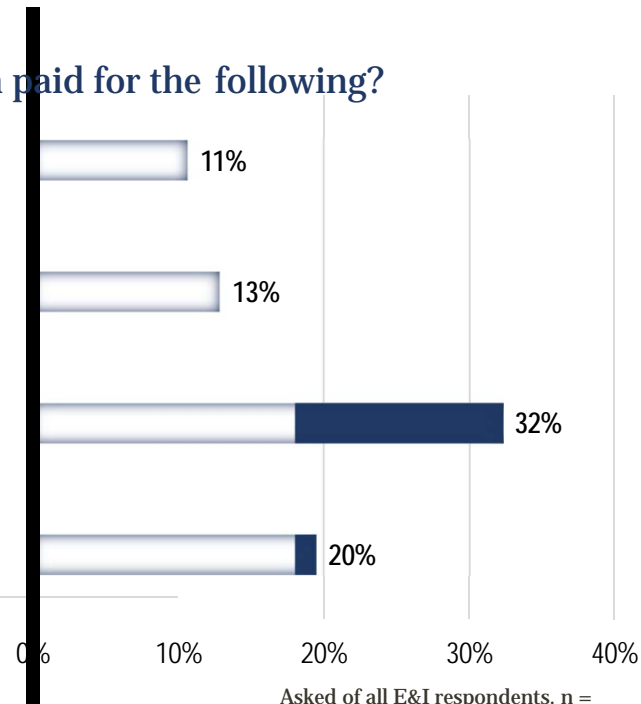
In the last 6 months, have you been paid for the following?

Renting out property, such as your car, your place of residence, or other items you own, through websites, newspaper ads, flyers, etc.

Completing online tasks through websites, such as Amazon Services, Mechanical Turk, Fiverr, TaskRabbit, YouTube. Such tasks might include taking photos, editing documents, reviewing resumes, writing songs,...

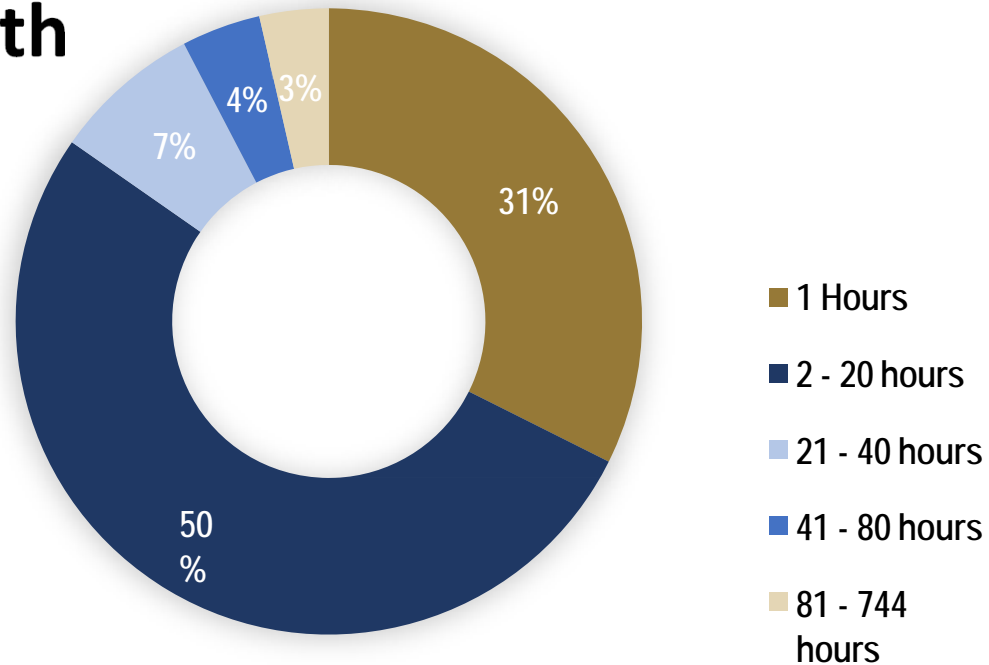
Selling new/used goods, handcrafts, etc., online through eBay, Craigslist, or other websites

Other online paid activities [text box]



Asked of all E&I respondents. n = 2,483

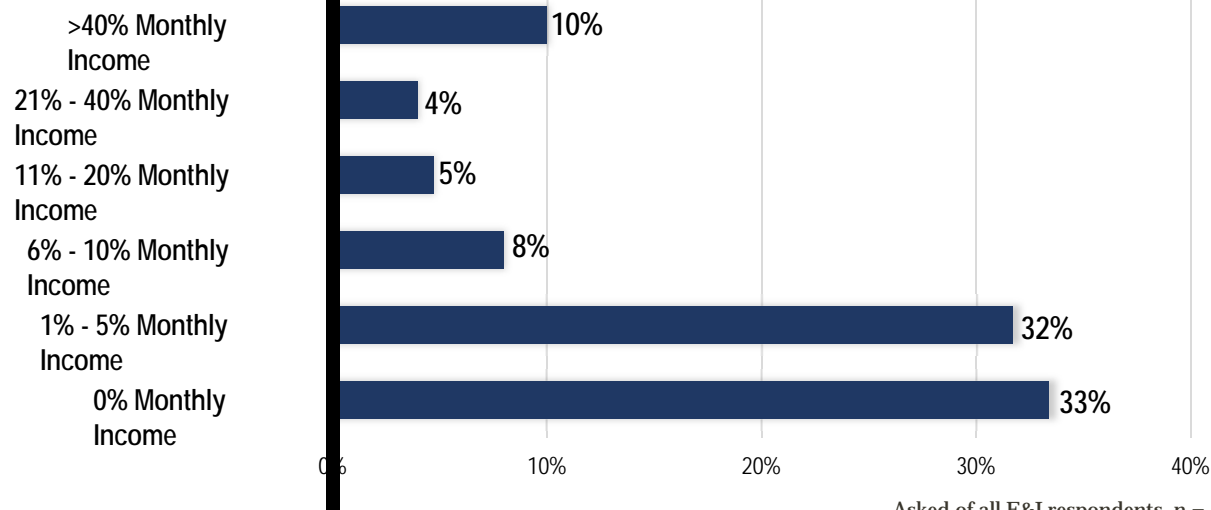
81% of Respondents Spend One to 20 Hours on Informal Work Activities Each Month



Asked of all E&I respondents. n = 2,483

Respondents Receive Monthly Income from Participation in Informal Work Activities

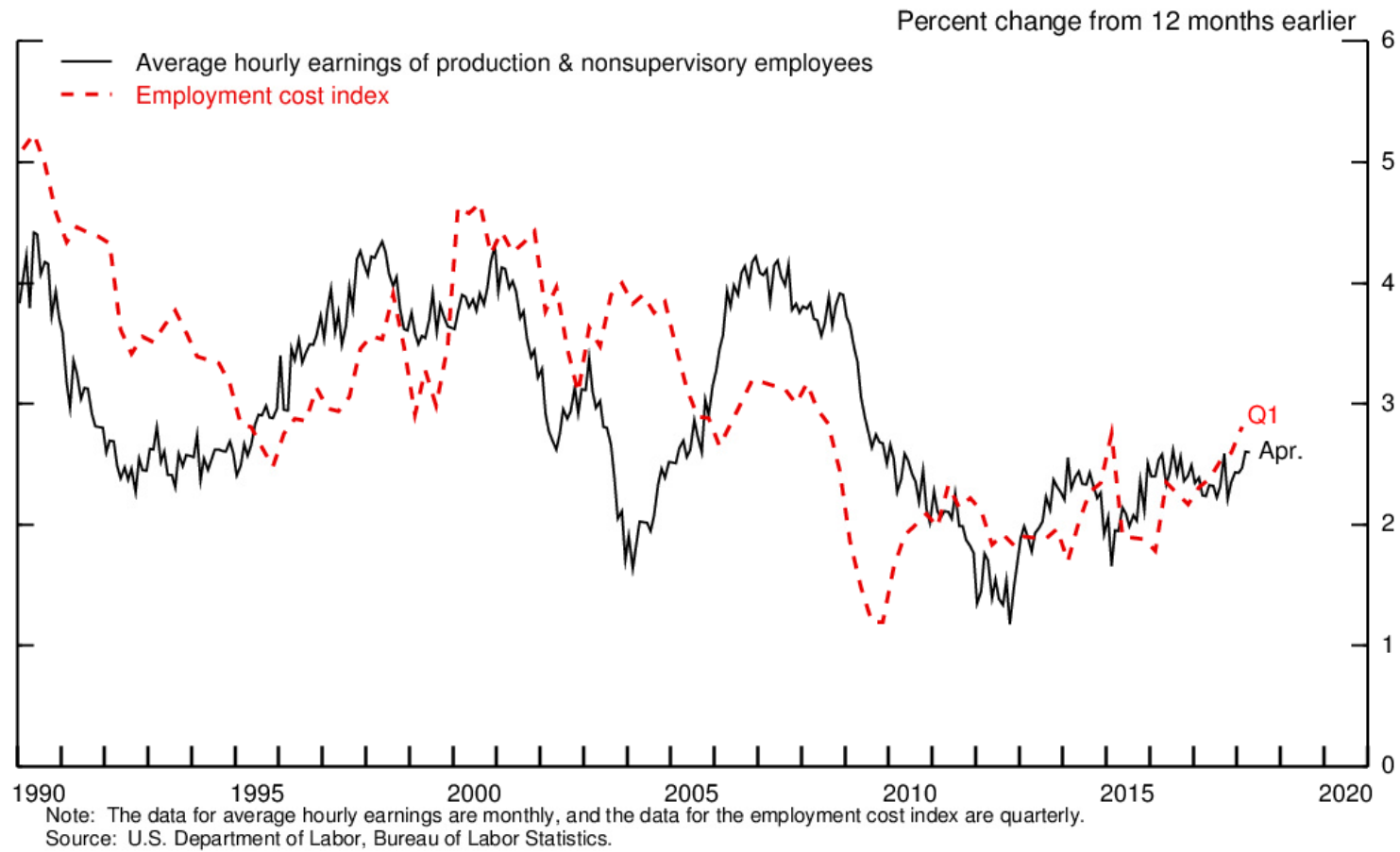
How much of your household monthly income do you usually get from paid work activities or side employment?



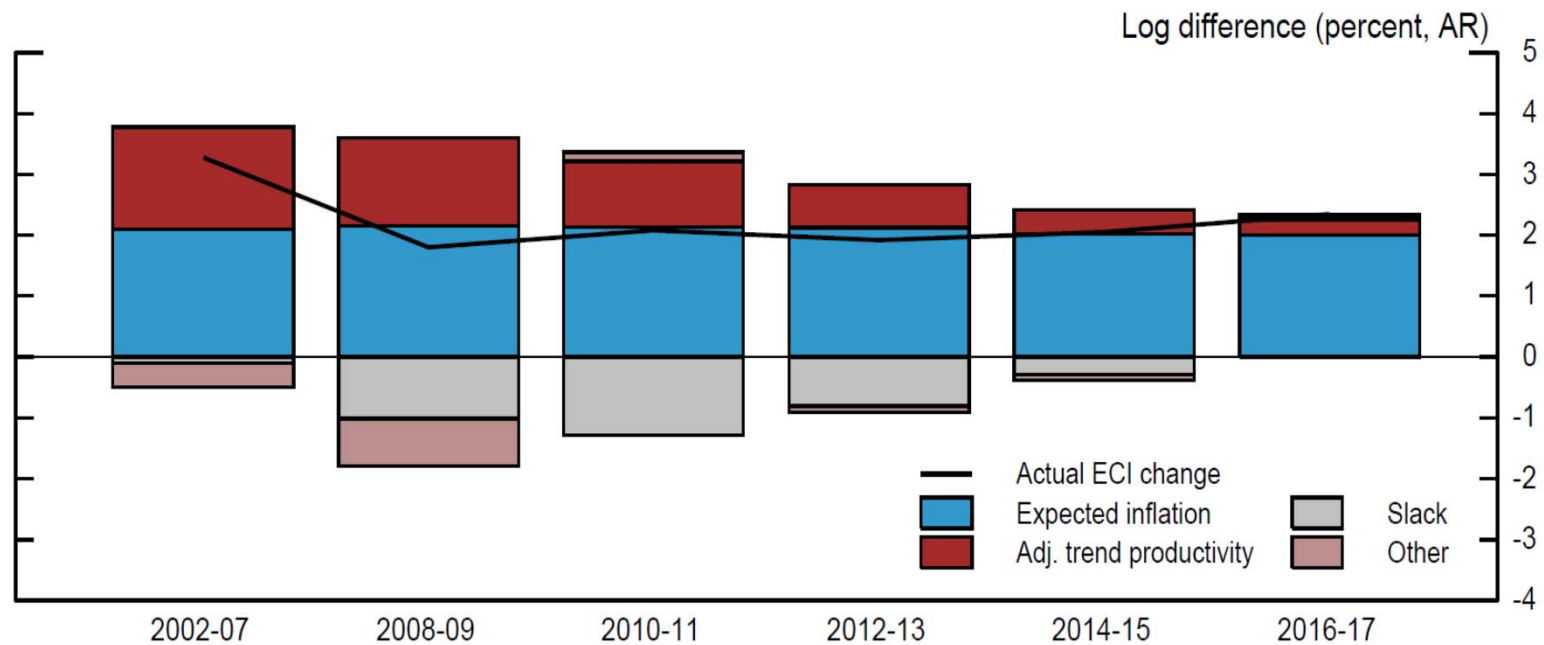
Asked of all E&I respondents. n = 2,483

Wages and Productivity

Wage growth

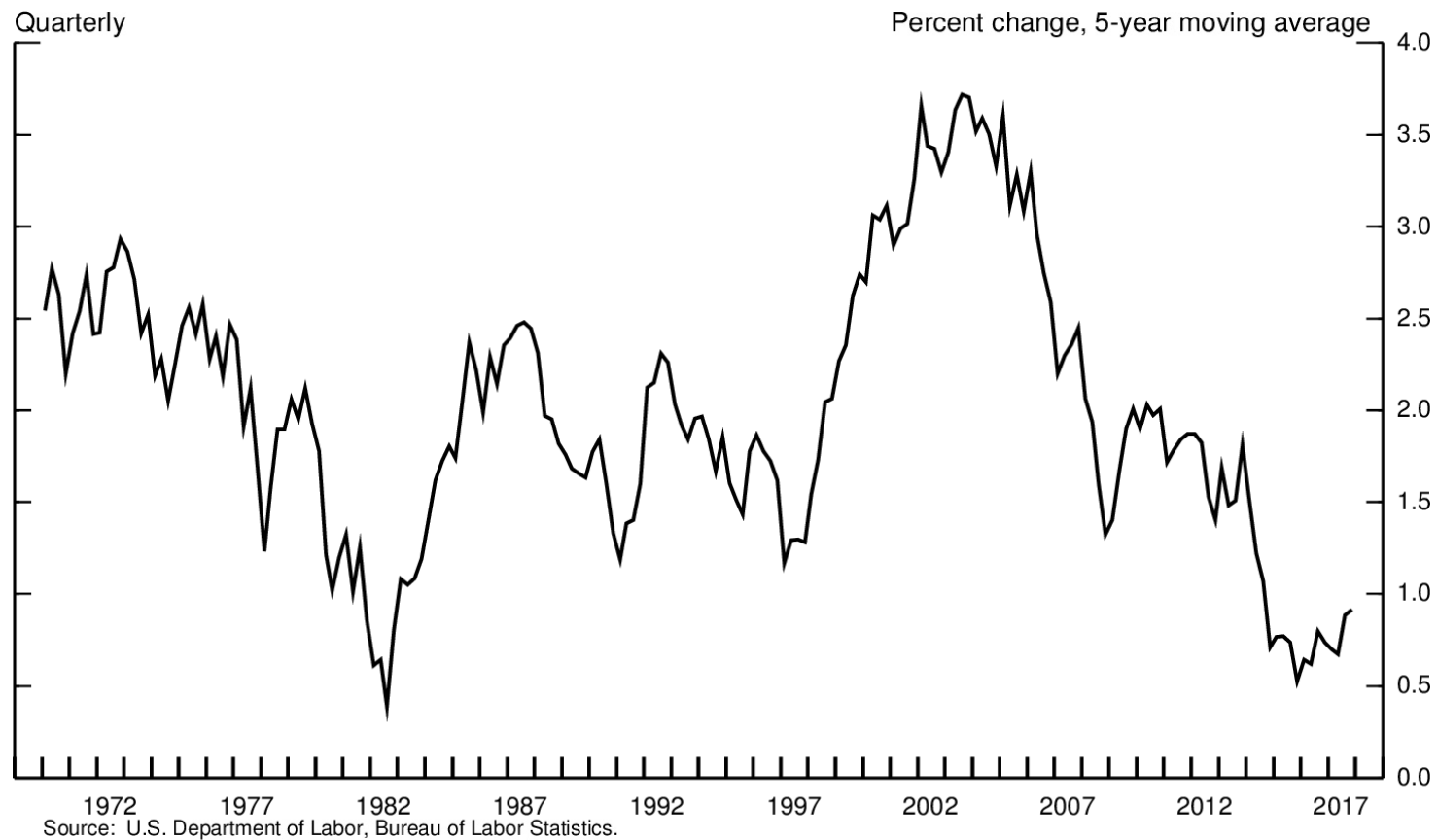


5. Decomposition of Annualized ECI Change

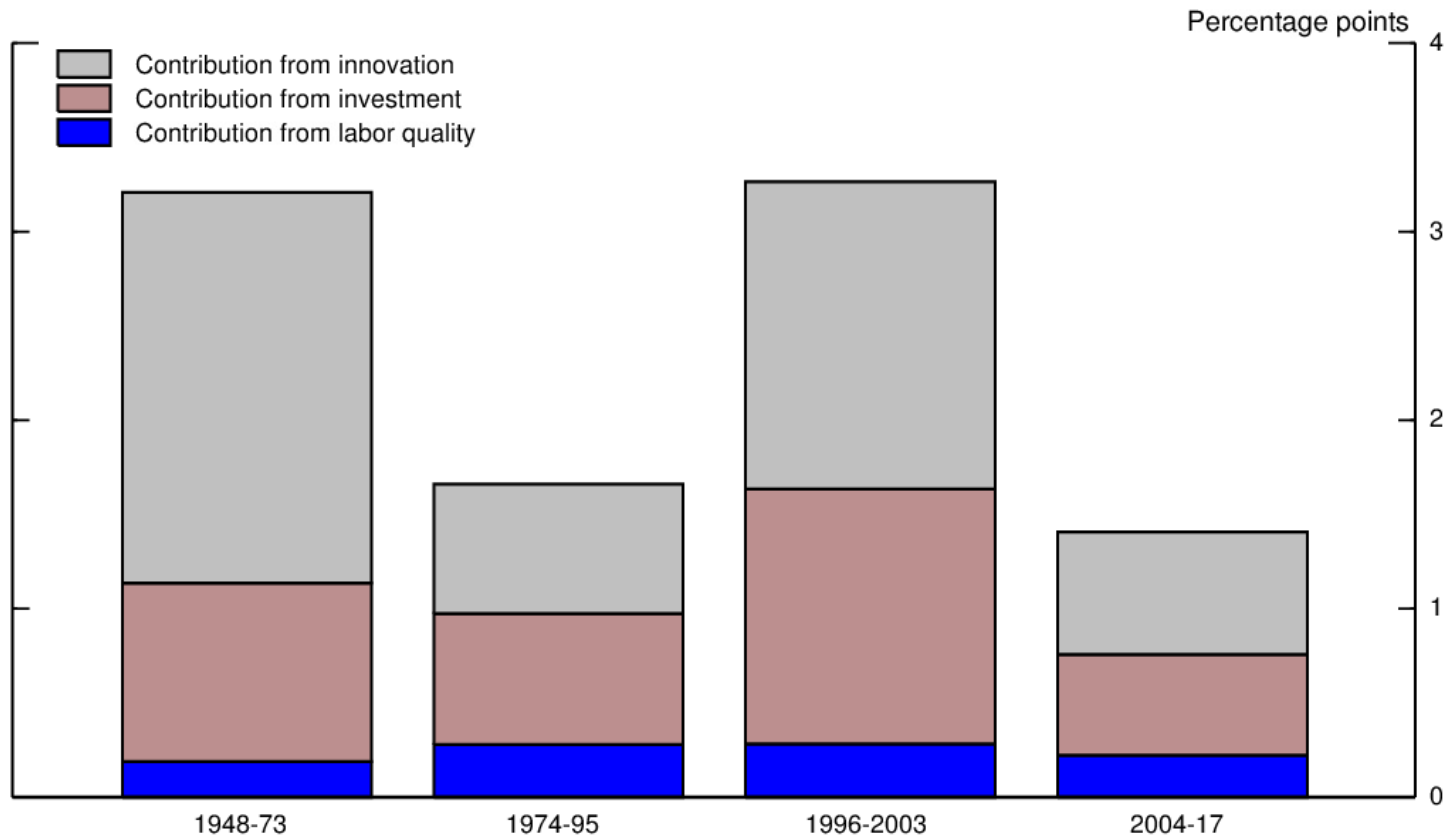


Note: Slack contribution combines the contributions of the level and first difference of the unemployment gap; trend productivity contribution includes the model's constant term.

10. Labor productivity growth is low

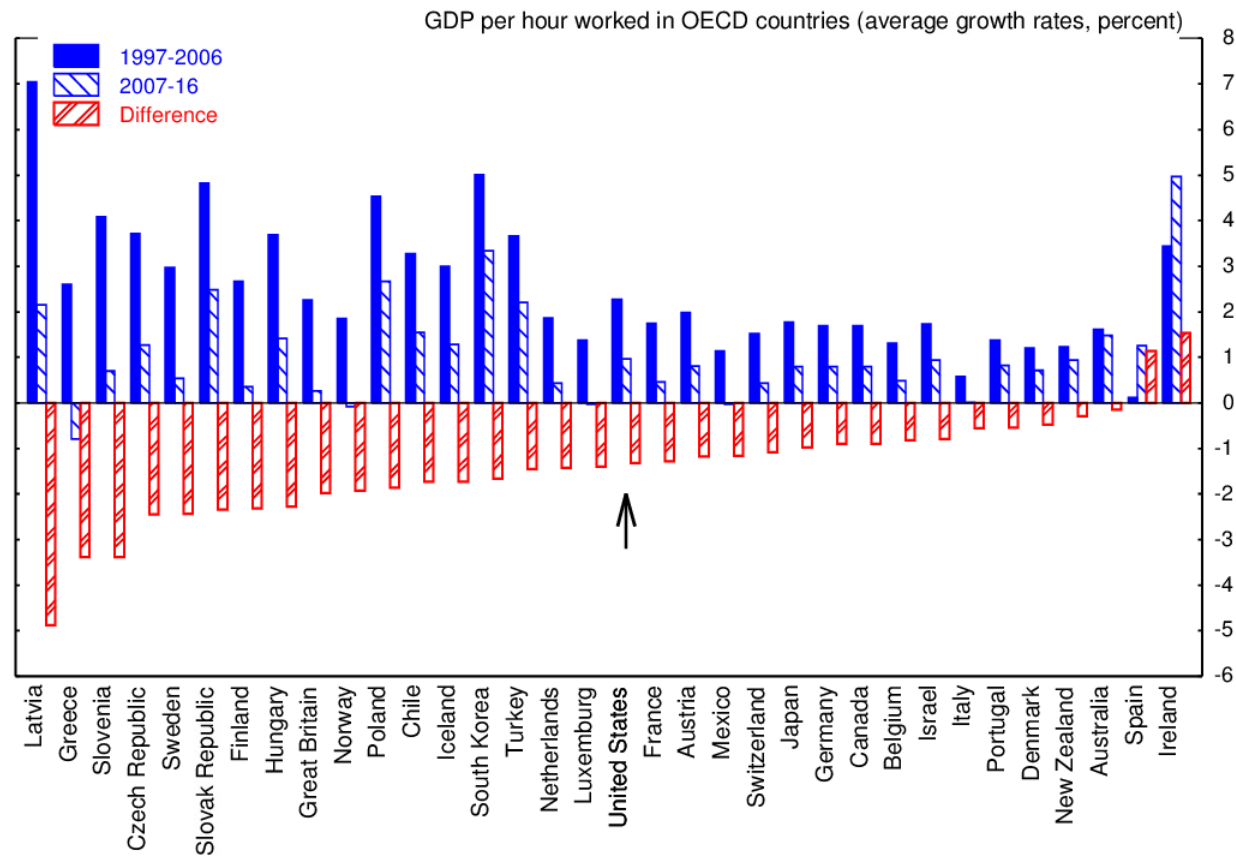


12. Sources of the slowing in productivity growth



Note: Chart key shows bars in order from top to bottom.
Source: John Fernald (2014), "A Quarterly, Utilization-Adjusted Series on Total Factor Productivity," Working Paper Series 2012-19 (San Francisco: Federal Reserve Bank of San Francisco, April; data updated February 1, 2018), <https://www.frbsf.org/economic-research/files/wp12-19bk.pdf>.

11. Productivity slowdown is global



Source: Organisation for Economic Co-operation and Development (OECD), <https://data.oecd.org/lprdy/gdp-per-hour-worked.htm#indicator-chart>.

Explanations for slower growth in innovation?

- Growing statistical mismeasurement of real output?
 - Does GDP omit the value of recent innovations? Perhaps, but recent research casts doubt on mismeasurement as a first-order story
- Structural factors that predate the Global Financial Crisis (GFC)
 - Recent technology (e.g. information technology) might be less revolutionary than earlier general-purpose technologies (e.g. electricity)
 - Reallocation of capital and labor may have become more sluggish
- Lingering effects from the severe GFC
 - R&D fell sharply during the GFC, partly in response to tight financial conditions and weak demand. R&D declines tend to induce gradual and persistent declines in innovation