Labor Supply
Across Countries and Over Time

EC502 Macroeconomics
Topic 7

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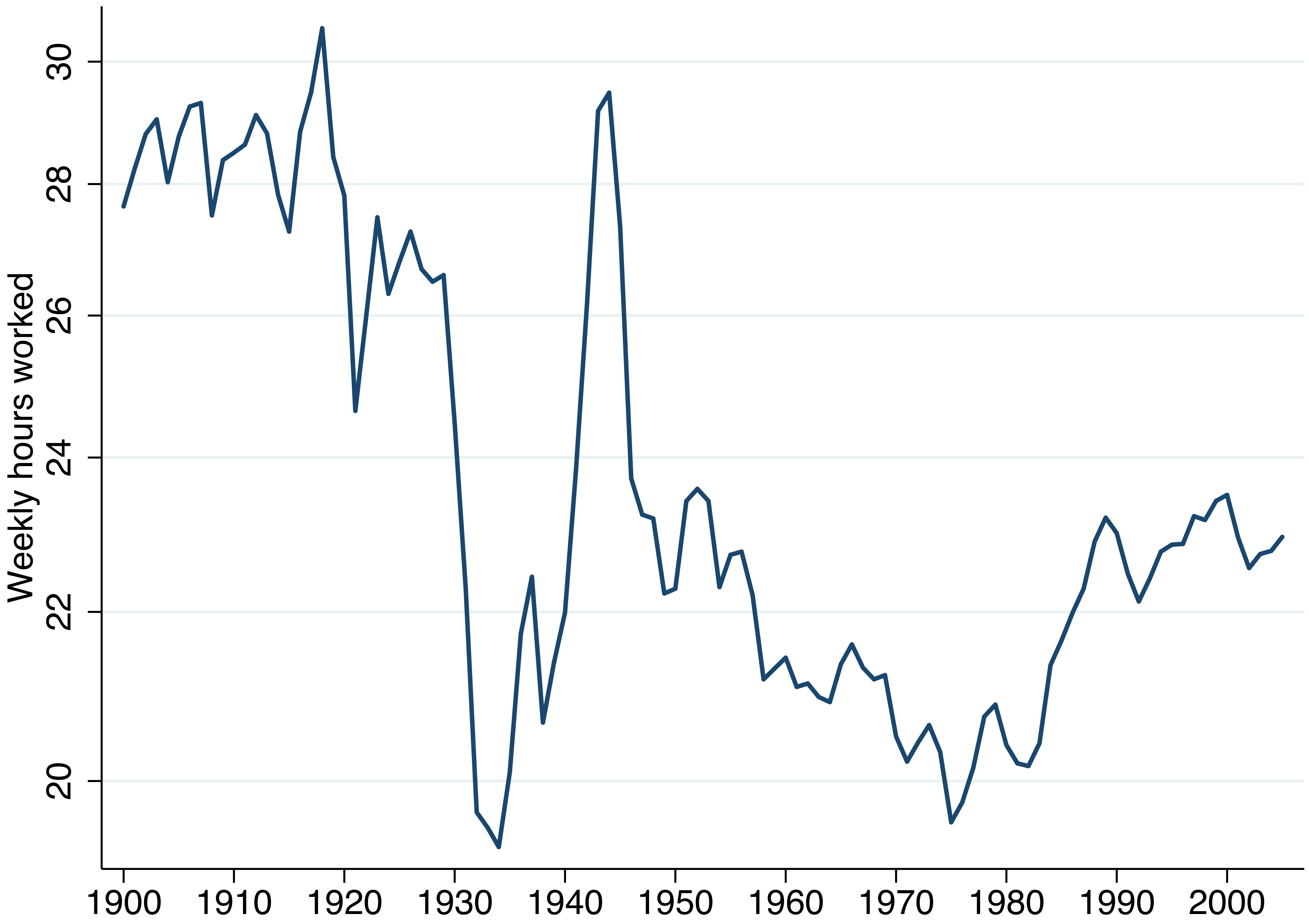
Hours Worked

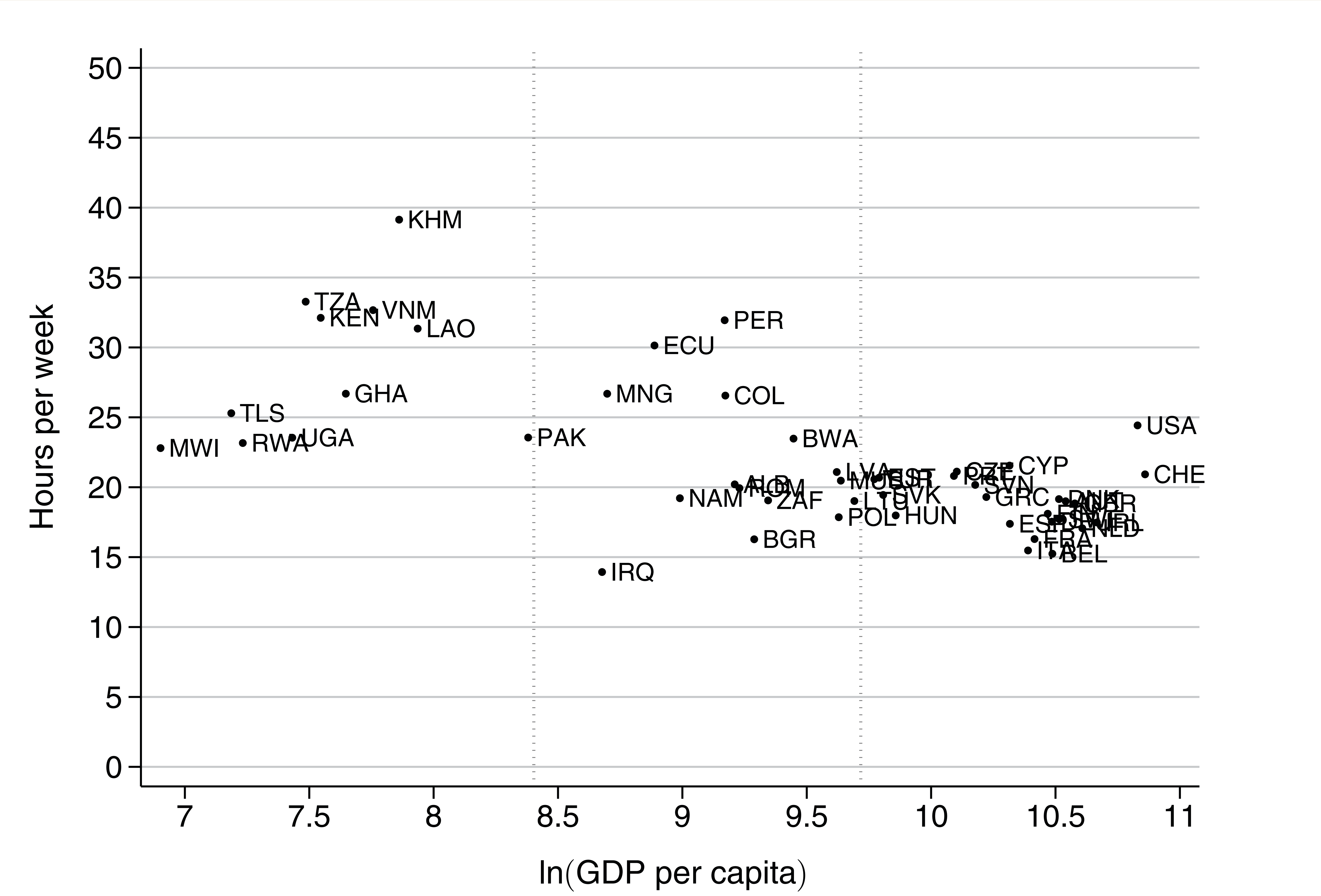
- We took the hours worked per person as exogenous so far
- We assumed that everyone supplies the same amount of labor
  - over time
  - across countries
- Is this true?

The U.S. Time-Series



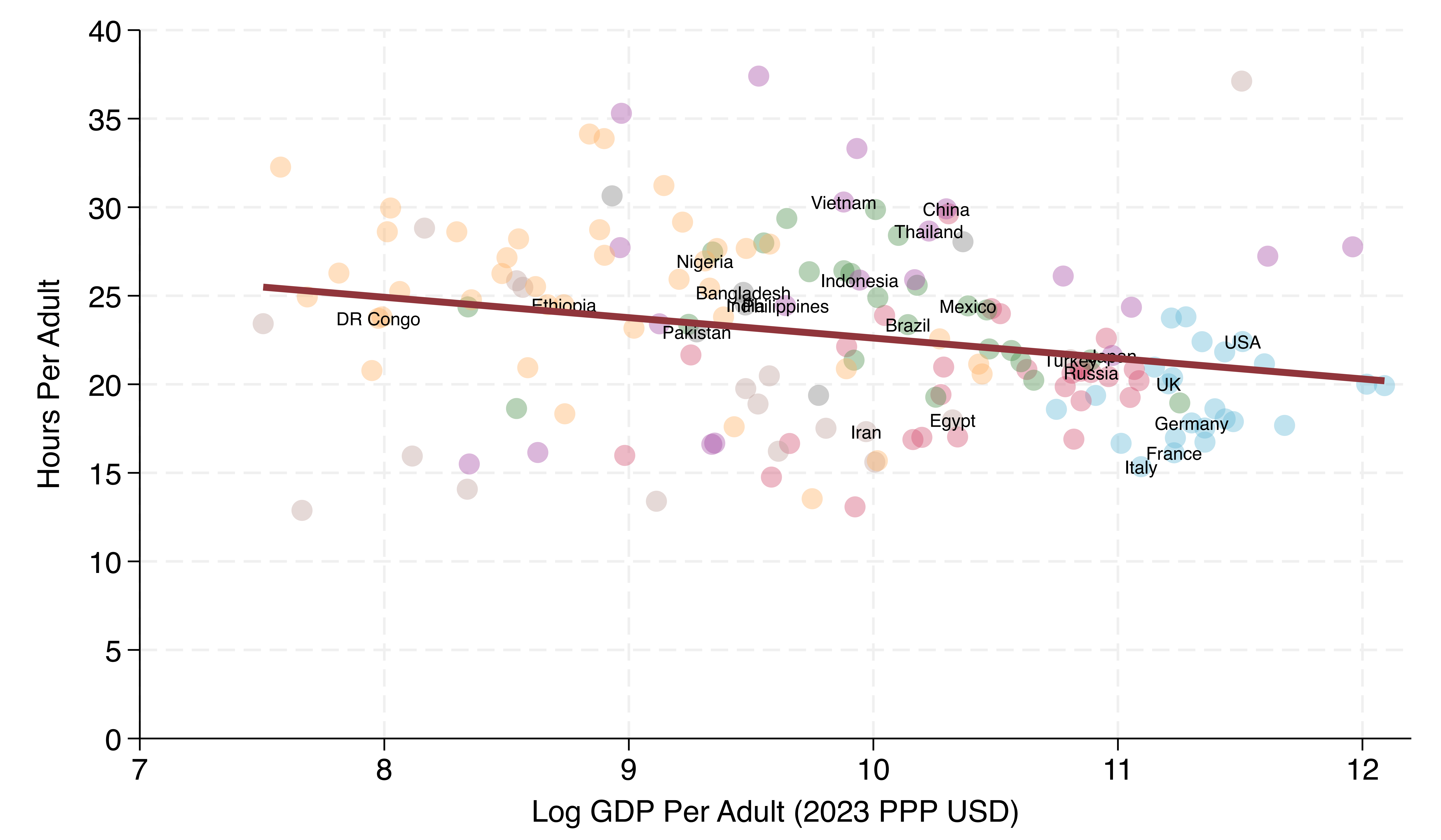
Source: Boppart and Krusell (2020)

Cross-Section in 2005



Source: Bick, Fuchs-Schündeln, Lagakos (2018)

Now More Comprehensive Data is Available



Source: Gethin & Saez (2026)

Question

- Over the time-series, as a country grows, people work less
- In the cross-section, richer countries tend to work less
  - Though the relationship is weaker with more comprehensive data
- What determines the hours worked in the time-series and in the cross-section?

A Simple Model of Labor Supply

A Model of Labor Supply

- What is the benefit of working more? – earn a higher income
- What is the cost of working more? – pain to work longer hours
- We introduce a minimal model that captures these trade-offs

Preferences

- Households have the following utility functions:

$$u(c) - v(l)$$

- We u is concave and v is convex:
  - $u'(c) > 0$: households are happier if consumption is higher
  - $u''(c) < 0$: additional consumption is less pleasant if already consuming a lot
  - $v'(l) > 0$: households are less happy if they work more
  - $v''(l) > 0$: additional hours of work are more painful if already working a lot
- The households face the following budget constraint

$$c = wl$$

Optimality Condition

- The households decide (c, l) subject to the budget constraint:

$$\max_{c,l} u(c) - v(l)$$

$$\text{s.t.} \quad c = wl$$

- First-order condition:

$$u'(c)w = v'(l)$$

  - LHS: marginal benefit of work
  - RHS: marginal cost of work

Functional Form Assumptions

- For simplicity, we assume

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}, \quad v(l) = \bar{v}\frac{l^{1+\nu}}{1+\nu}$$

with $\sigma > 0$ and $\nu > 0$

- One can check:
  - $u'(c) = c^{-\sigma} > 0, \quad u''(c) = -\sigma c^{-\sigma-1} < 0$
  - $v'(l) = \bar{v}l^{\nu} > 0, \quad v''(l) = \bar{v}\nu l^{\nu-1} > 0$

- For $\sigma = 1$,

$$u(c) = \log c \quad \text{when } \sigma = 1$$

  - Obtained as a limit of $\sigma \to 1$ (apply L'hopital's rule)

Optimal Labor Supply Solutions

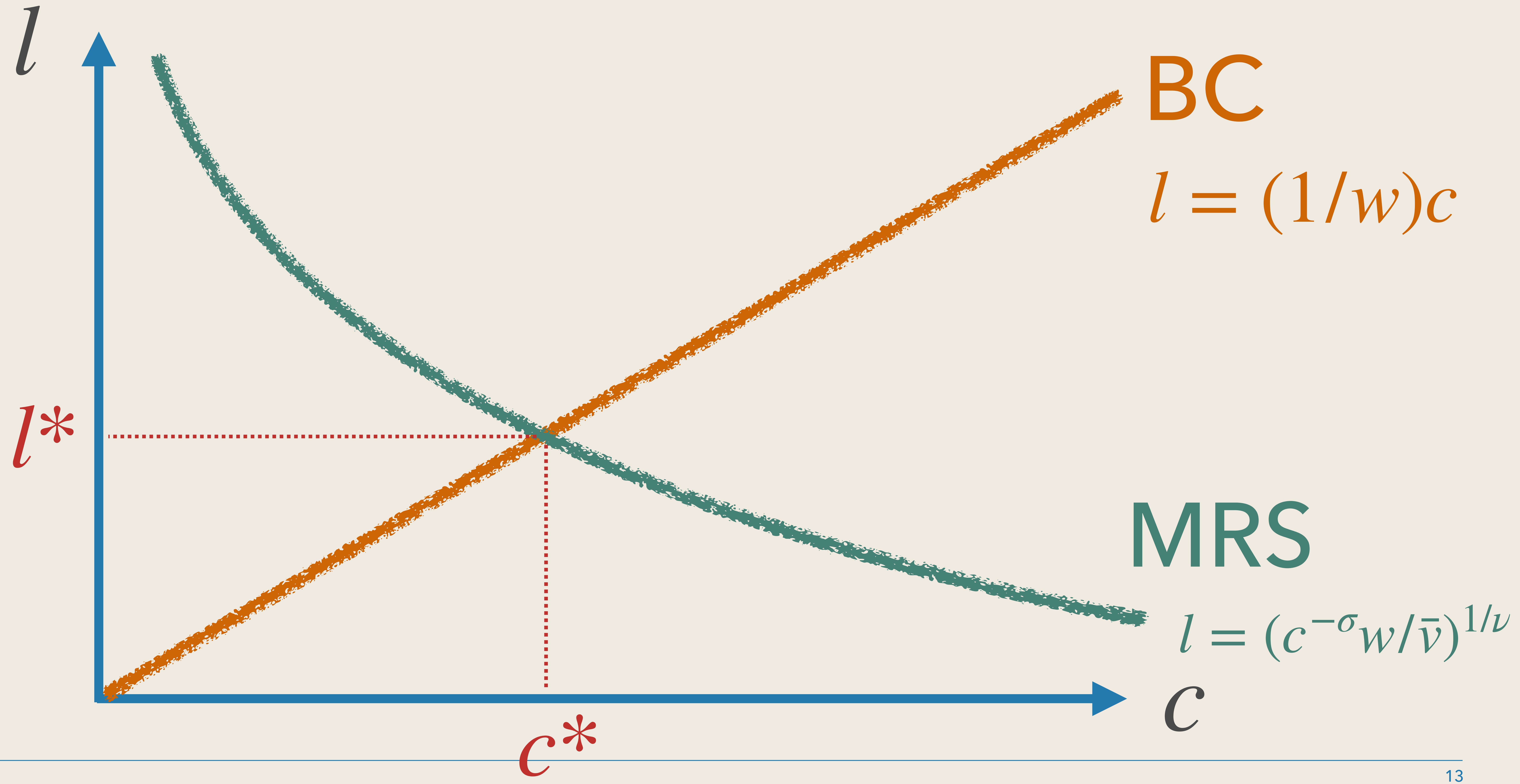
- Consumption and hours worked, $\{c, l\}$, jointly solve

$$c^{-\sigma} w = \bar{\nu} l^{\nu} \qquad \textbf{(MRS)}$$

$$c = wl \qquad \textbf{(BC)}$$

1. **(MRS)** defines a decreasing relationship between c and l
2. **(BC)** defines an increasing relationship between c and l

Graphical Representation



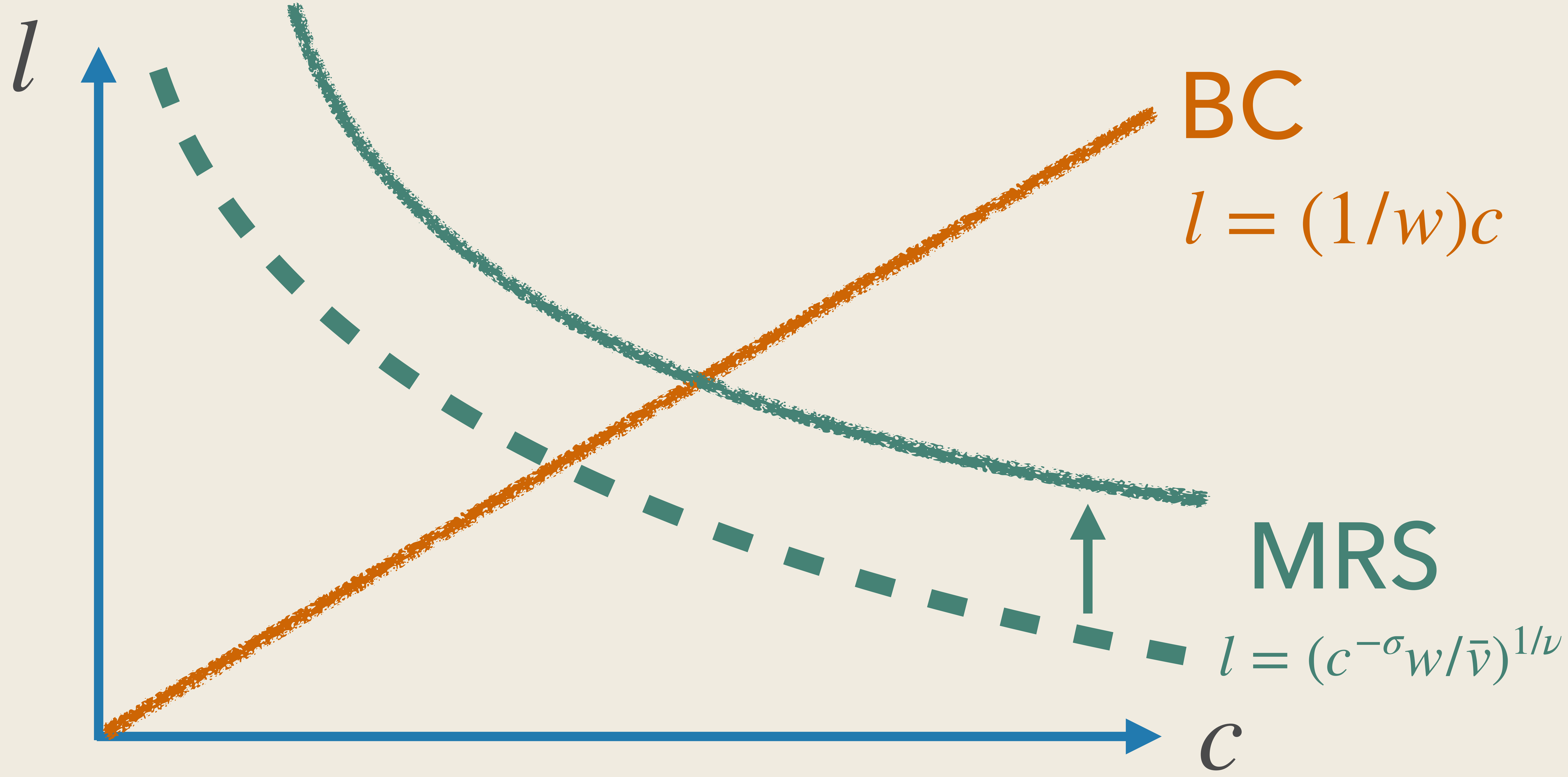
Question

$$c^{-\sigma} w = \bar{v} l^{\nu} \qquad \text{(MRS)}$$

$$c = wl \qquad \text{(BC)}$$

- As a country gets richer, what happens to the labor supply?
- We will consider an increase in wage, w
- Note that wage, w, appears in two places (orange and green)

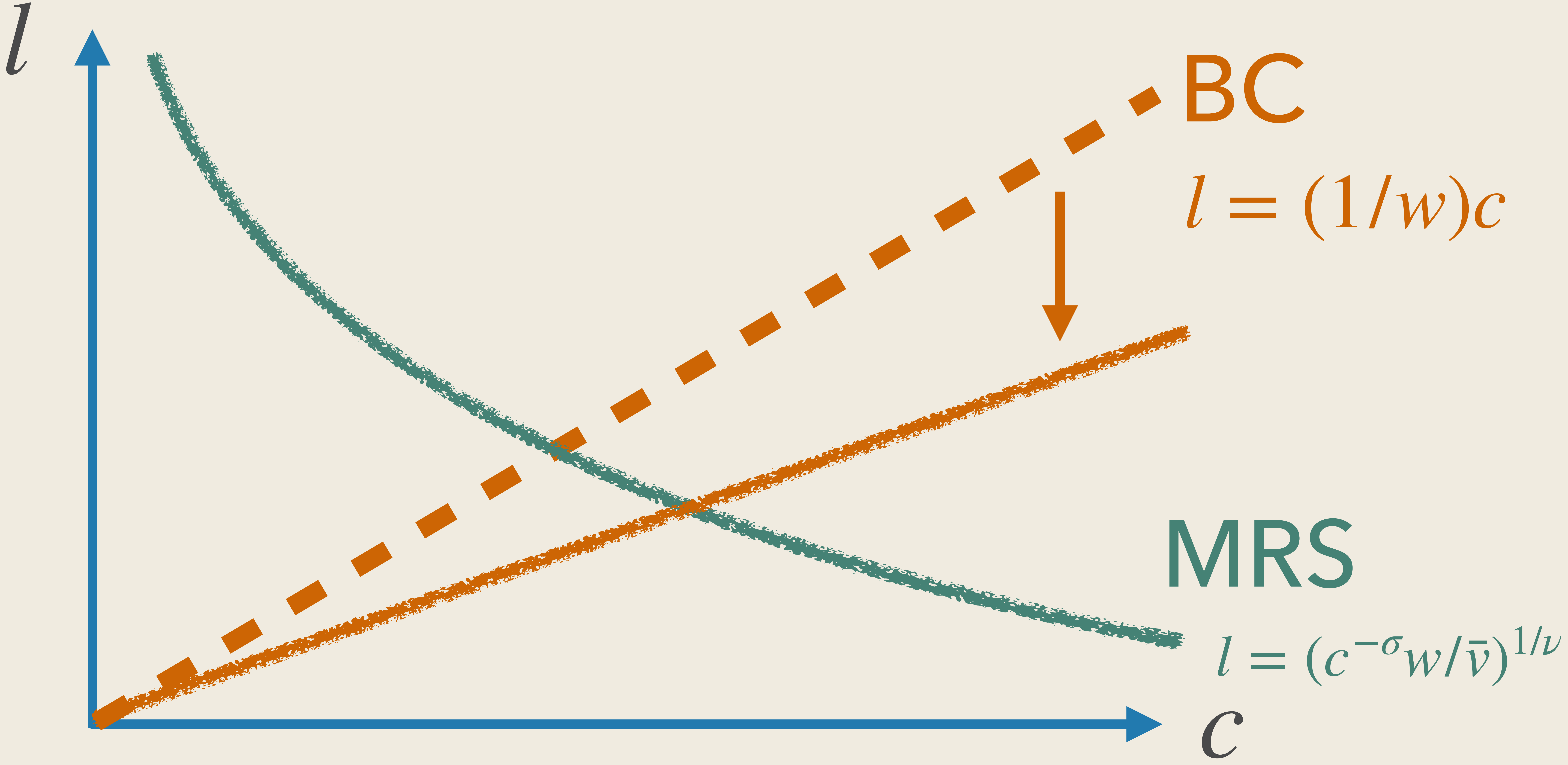
First Effect: Shift Up in MRS Curve



Substitution Effect

- MRS curve shifts up when w goes up
- If wages are higher, the marginal benefit of working is higher for any given c
- Holding the BC curve fixed, this means the labor supply, l, goes **up**!
- We call this a **substitution effect**

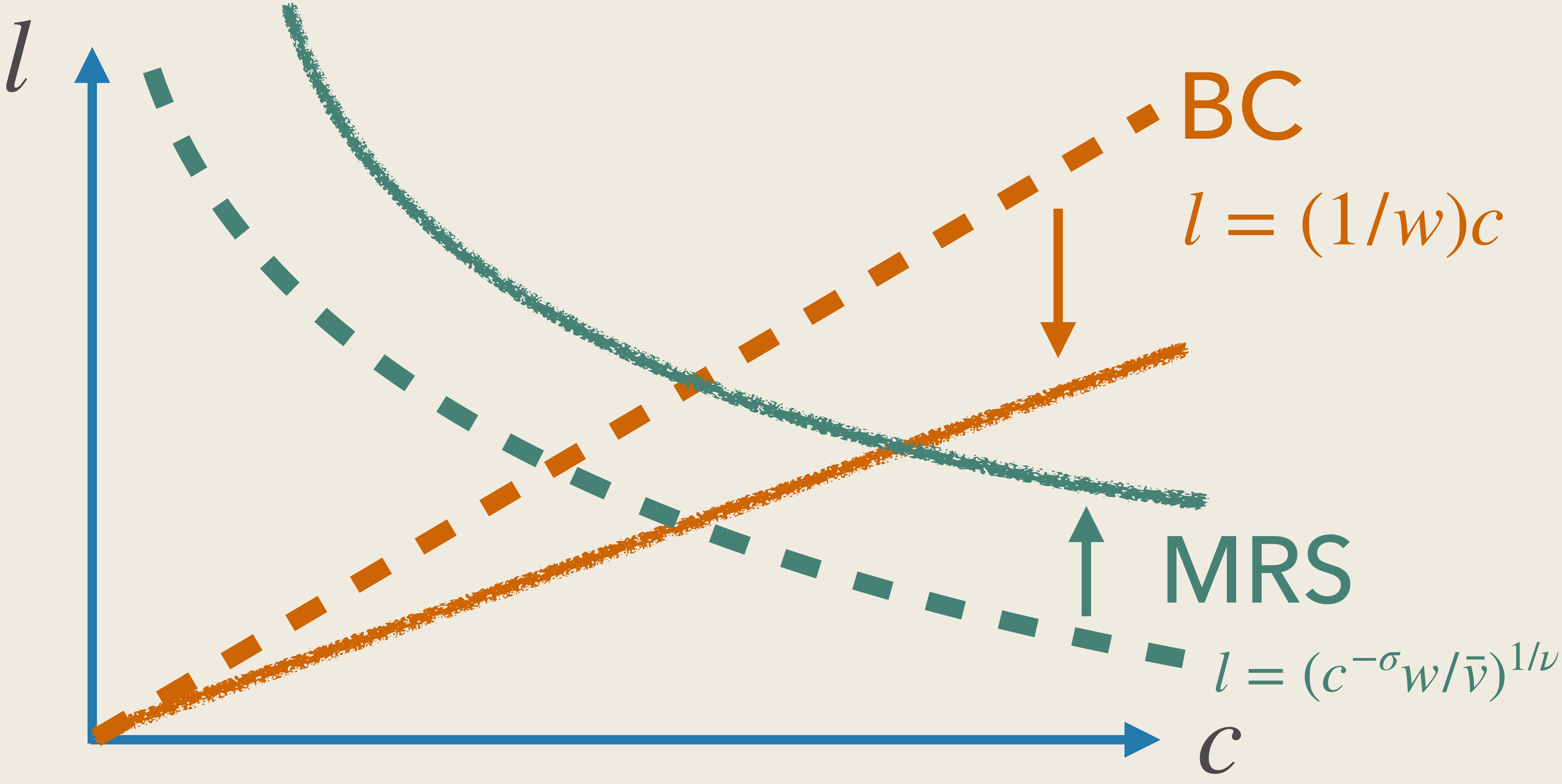
Second Effect: Shift Down in BC Curve



Income Effect

- The BC curve shifts down when w goes up
  - If wages are higher, the budget constraint implies c is higher for any given l
- Holding the MRS curve fixed, this means the labor supply, l, goes **down**!
- If I get richer, I don't need to work hard to achieve a given level of c
- We call this the **income effect**

Putting Two Effects Together



Higher or Lower Labor Supply?

- So, does the labor supply go up or down when w goes up?
- Not clear
- In fact, it can go either way

Solving for l

$$c^{-\sigma} w = \bar{v} l^{\nu} \qquad \textbf{(MRS)}$$

$$c = w l \qquad \textbf{(BC)}$$

$$\Rightarrow \quad l = \bar{v}^{\frac{-1}{\nu+\sigma}} w^{\frac{1}{\sigma+\nu}} w^{\frac{-\sigma}{\sigma+\nu}}$$

σ Determines the Relative Importance

$$l = \bar{v}^{\frac{-1}{\nu+\sigma}} w^{\frac{1}{\sigma+\nu}} w^{\frac{-\sigma}{\sigma+\nu}}$$

$$= \bar{v}^{\frac{-1}{\nu+\sigma}} w^{\frac{1-\sigma}{\sigma+\nu}}$$

1. $\sigma < 1$: l is increasing in w. Substitution effect dominates income effect
2. $\sigma > 1$: l is decreasing in w. Income effect dominates substition effect
3. $\sigma = 1$: l is invariant to w. Income effect and substition effect cancel

Endogeneizing w

- Now we endogenize wages, w
- Suppose the firm operates the following production function

$$y = Al$$

- Firms solve

$$\max_{l} Al - wl$$

- In equilibrium,

$$w = A$$

- Plugging it back,

$$l = \bar{v}^{\frac{1}{\nu+\sigma}} A^{\frac{1-\sigma}{\sigma+\nu}}$$

Can We Qualitatively Explain Two Facts?

- Taking log,

$$\log l = \frac{1-\sigma}{\sigma+\nu} \log A + const\,.$$

- Suppose that $\sigma > 1$

  1. Rich (high A) countries work less than poor countries
  2. As countries grow (higher A), they work work less

- If income effect dominates substitution effect, we can explain aggregate data

Can We Quantitatively Explain Two Facts?

- Over time-series

$$g_l = \frac{1-\sigma}{\sigma+\nu} g_A + \epsilon_t$$

  - Calculations from the US data suggest $g_l \approx -0.4\%$ and $g_A \approx 2\%$
  - This suggests $\frac{1-\sigma}{\sigma+\nu} \approx -0.2$

- In the cross-section,

$$\log l_i = \frac{1-\sigma}{\sigma+\nu} \log A_i + \epsilon_i$$

  - Regression estimates by Bick, Fuchs-Schündeln, Lgakos (2015), $\frac{1-\sigma}{\sigma+\nu} \approx -0.15$
  - Using Gethin & Saez (2026) data, $\frac{1-\sigma}{\sigma+\nu} \approx -0.08$

Income Effect from Labor Supply: Direct Evidence – Golosov, Graber, Mogstad & Novgorodsky (2023)

Direct Evidence?

- Hours worked tend to, if anything, decline as an economy gets richer
- The model suggests that a strong income effect, $\sigma \geq 1$, is the key reason
- Do we have direct evidence of the income effect?
- What is the ideal experiment?
- What is the concern with using the aggregate data?

Isolating Income Effect

- Maybe wage is not the only thing that changes over time and across countries
- The ideal experiment that isolates the income effect:
  - Give money to people and see how they change the labor supply
- If income effect is big, we will see a big reduction in labor supply
- If income effect is small, we will not see a major change in labor supply

Conceptual Framework

- Add non-labor income T to the previous model,

$$\max_{c,l} u(c) - v(l)$$

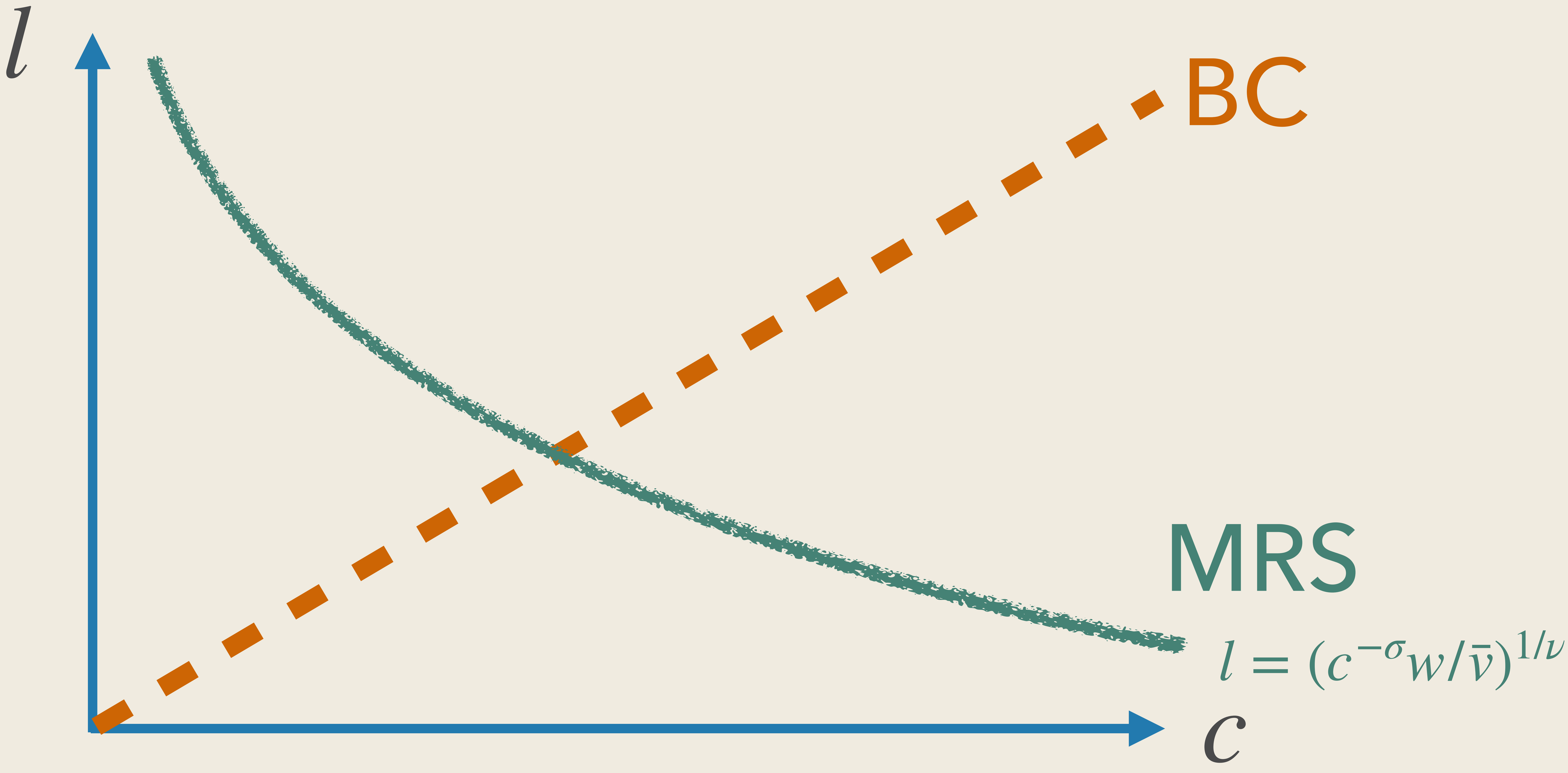
$$\text{s.t.} \quad c = wl + T$$

- Assuming $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$ and $v(l) = \bar{v}\frac{l^{1+\nu}}{1+\nu}$, $\{c, l\}$, jointly solve

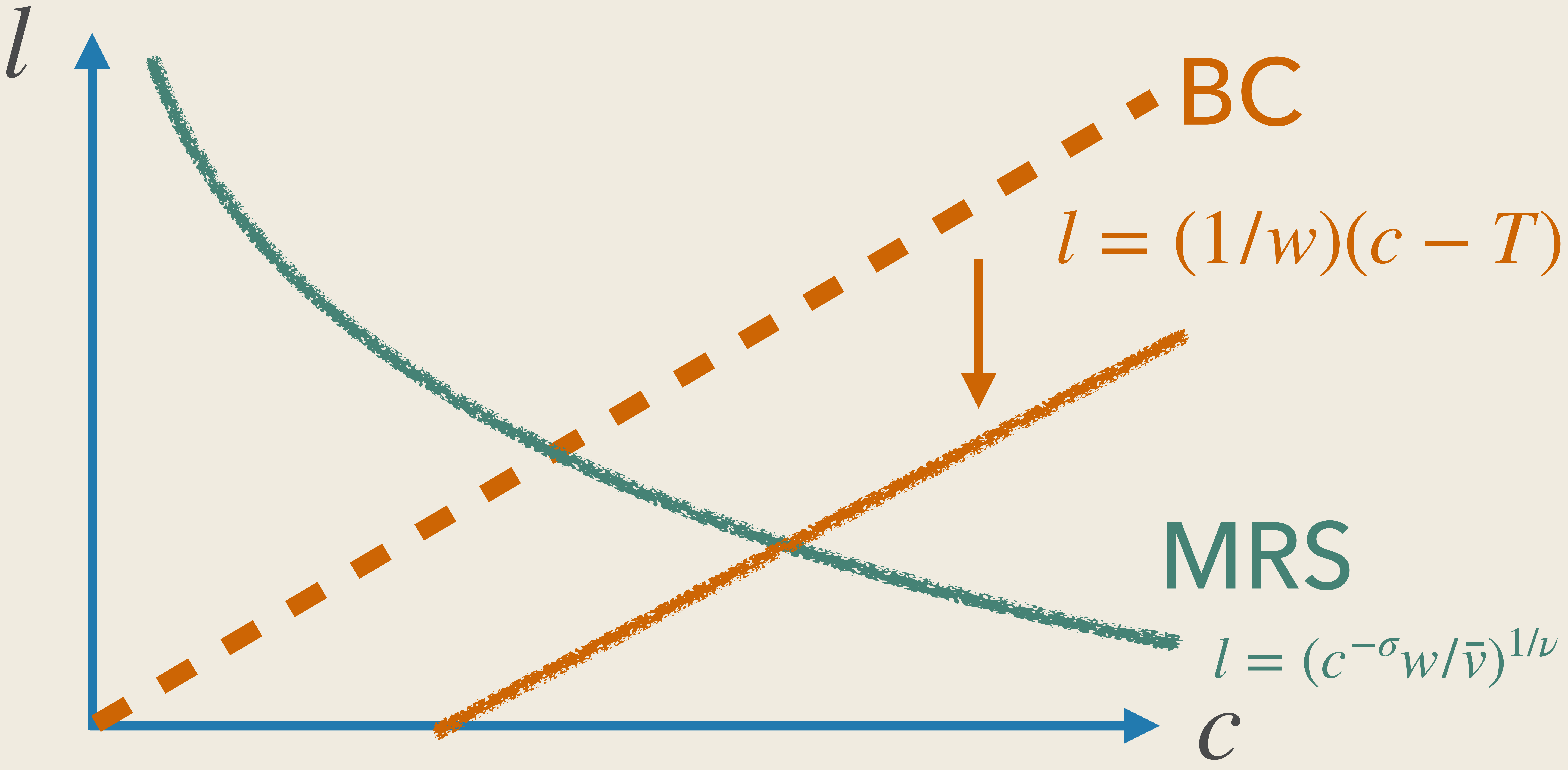
$$c^{-\sigma} w = \bar{v} l^{\nu} \qquad \textbf{(MRS)}$$

$$c = wl + T \qquad \textbf{(BC)}$$

Impact of Lottery Winning $T \uparrow$



Impact of Lottery Winning $T \uparrow$



Marginal Propensity to Earn

- Empirically, it is convinient to look at MPE out of $T \equiv \frac{d(wl)}{dT}$
  - MPE = marginal propensity to earn
- One can show:

$$MPE = \frac{d(wl)}{dT} = \frac{-\sigma s_w}{\left[\sigma s_w + \nu\right]}$$

where $s_w = \frac{wl}{wl + T}$ is the share of wage income in total income

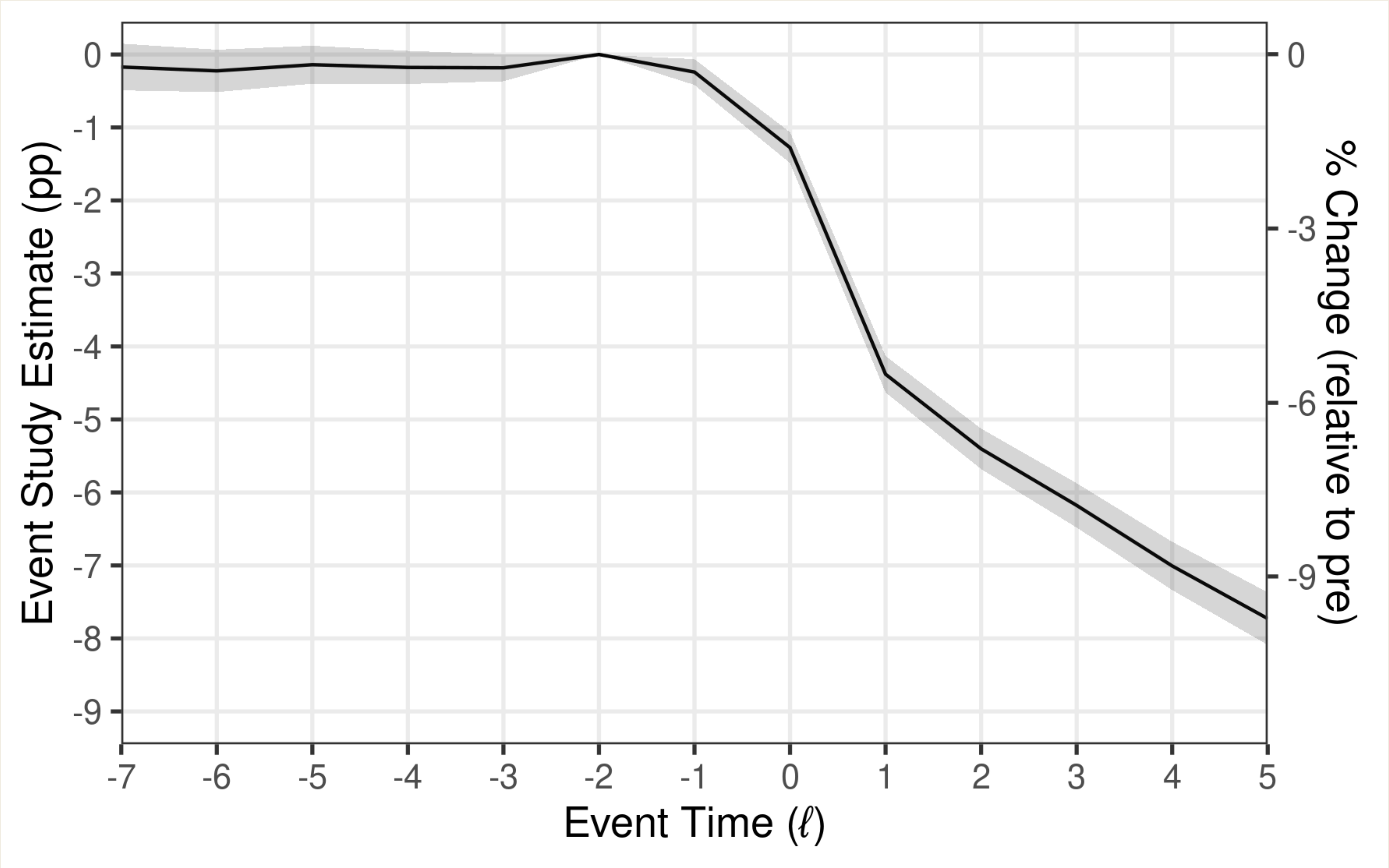
- MPE speaks to the importance of σ:
  If $\sigma = 0$, $MPE = 0$. If σ is very big, MPE is very negative.

Labor Supply Response of Lottery Winners

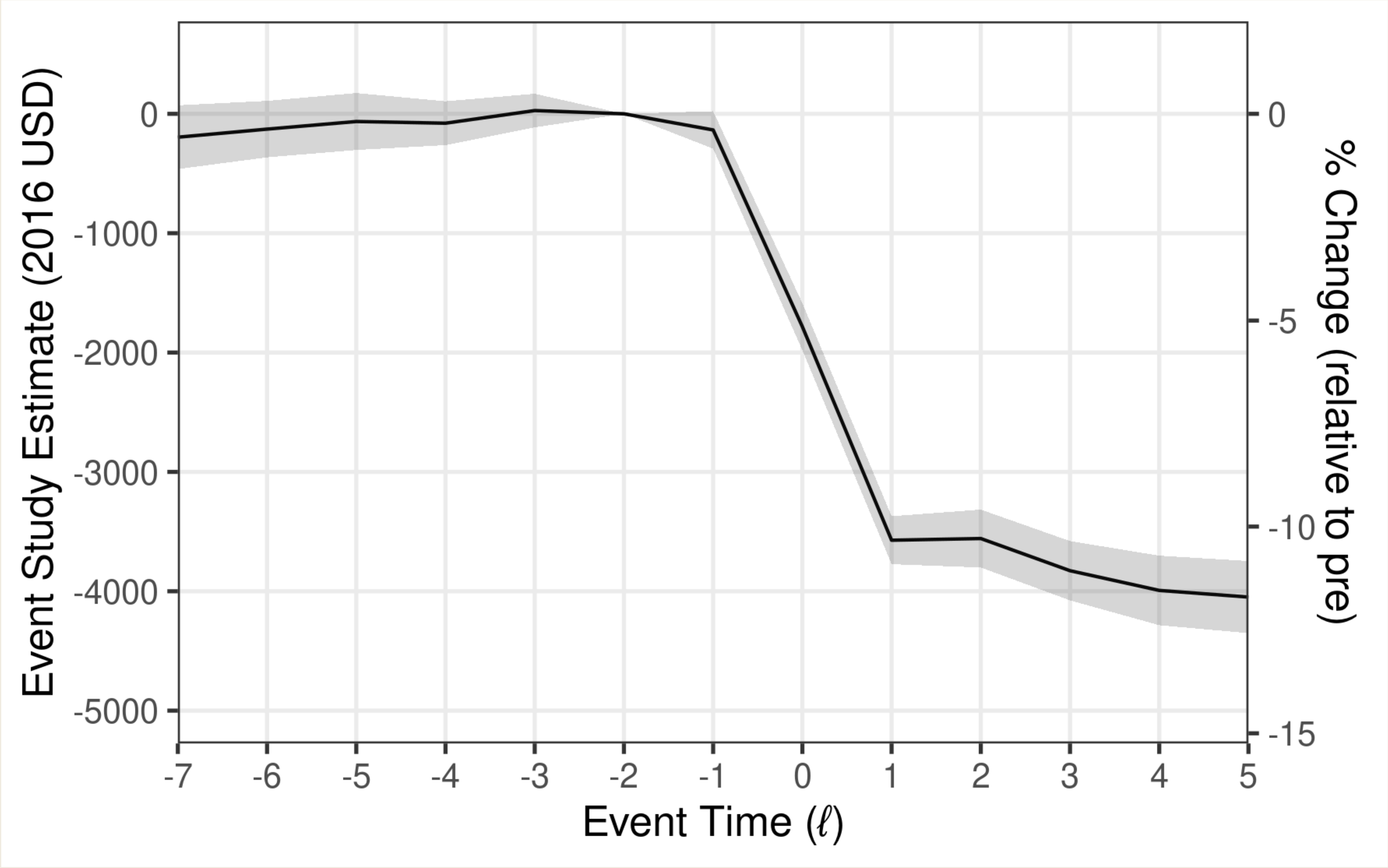
- Golosov, Graber, Mogstad & Novgorodsky (2023):
  Study the labor supply responses of US lottery winners
- US tax data for 1999-2016
  - Lottery winnings are taxable income
- Median size of post-tax winning: $43,600
- 90,731 lottery winners in the sample
- Compare the response to lottery winnings relative to later winners

Labor Supply Response to Lottery Winning

Emloyment



Wage Earnings



Source: Golosov, Graber, Mogstad & Novgorodsky (2023)

MPE Estimates

Table 4.1: IV estimates of the effect of exogenous change in unearned income

	Sample				
Outcome	Full Sample (1)	Quartile 1 Pre-Win Income (2)	Quartile 2 Pre-Win Income (3)	Quartile 3 Pre-Win Income (4)	Quartile 4 Pre-Win Income (5)
Per-Adult Total Labor Earnings	-0.5227 (0.0146)	-0.3080 (0.0240)	-0.5204 (0.0197)	-0.5893 (0.0221)	-0.6735 (0.0389)

Source: Golosov, Graber, Mogstad & Novgorodsky (2023)

- Therefore

$$\frac{d(wl)}{dT} = -\frac{\sigma s_w}{[\sigma s_w + \nu]} \approx -0.52$$

- Assuming $s_w \approx 2/3$ (labor share) and $\nu \in [0.025, 0.5]$ (micro estimates) implies

$$\sigma \in [0.04, 0.8]$$

- Can be large, but not as large as $\sigma > 1$

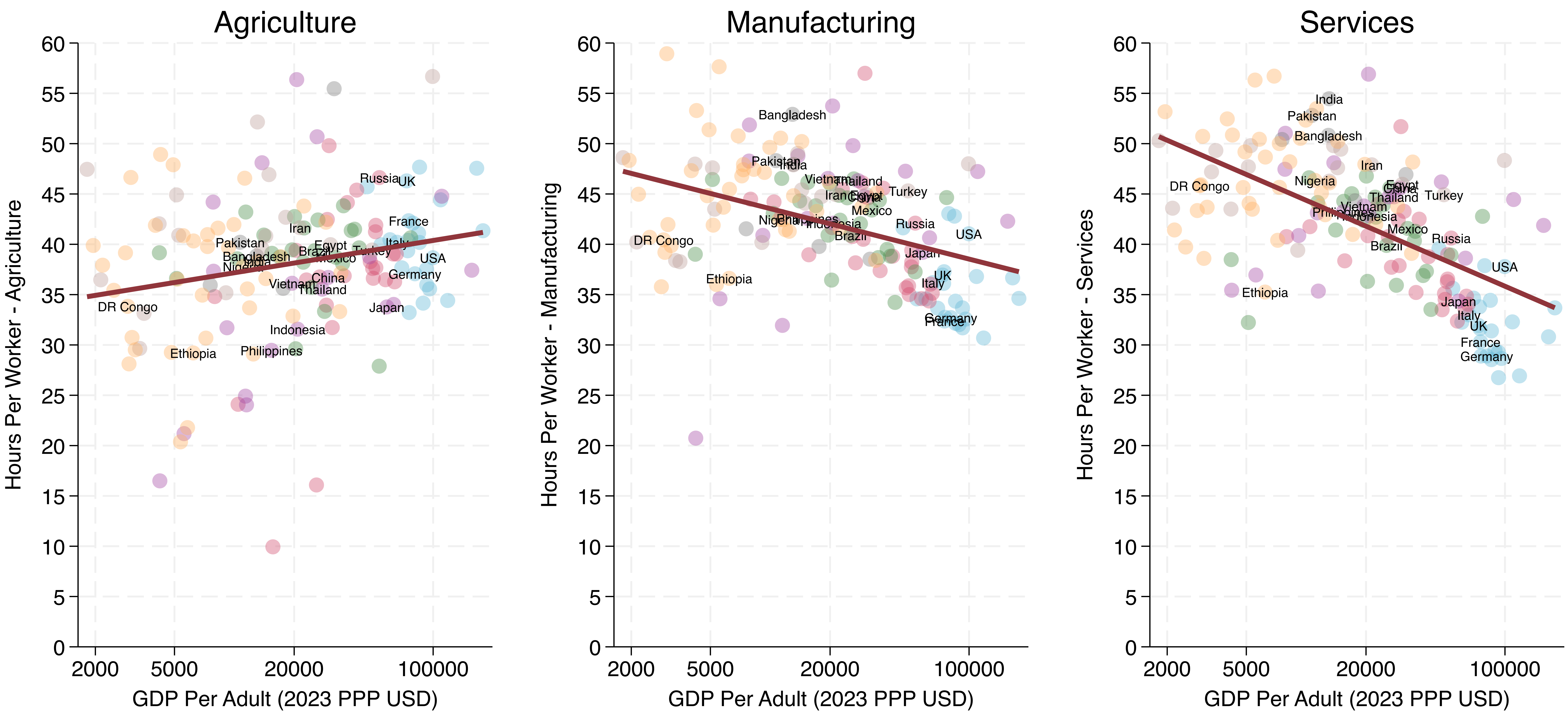
Chetty, Guren, Manoli, & Weber (2013), Martínez, Saez, & SSiegenthaler (2021)

Closer Look at the Data
– Gethin & Saez (2026)

Hours per Worker vs. Employment

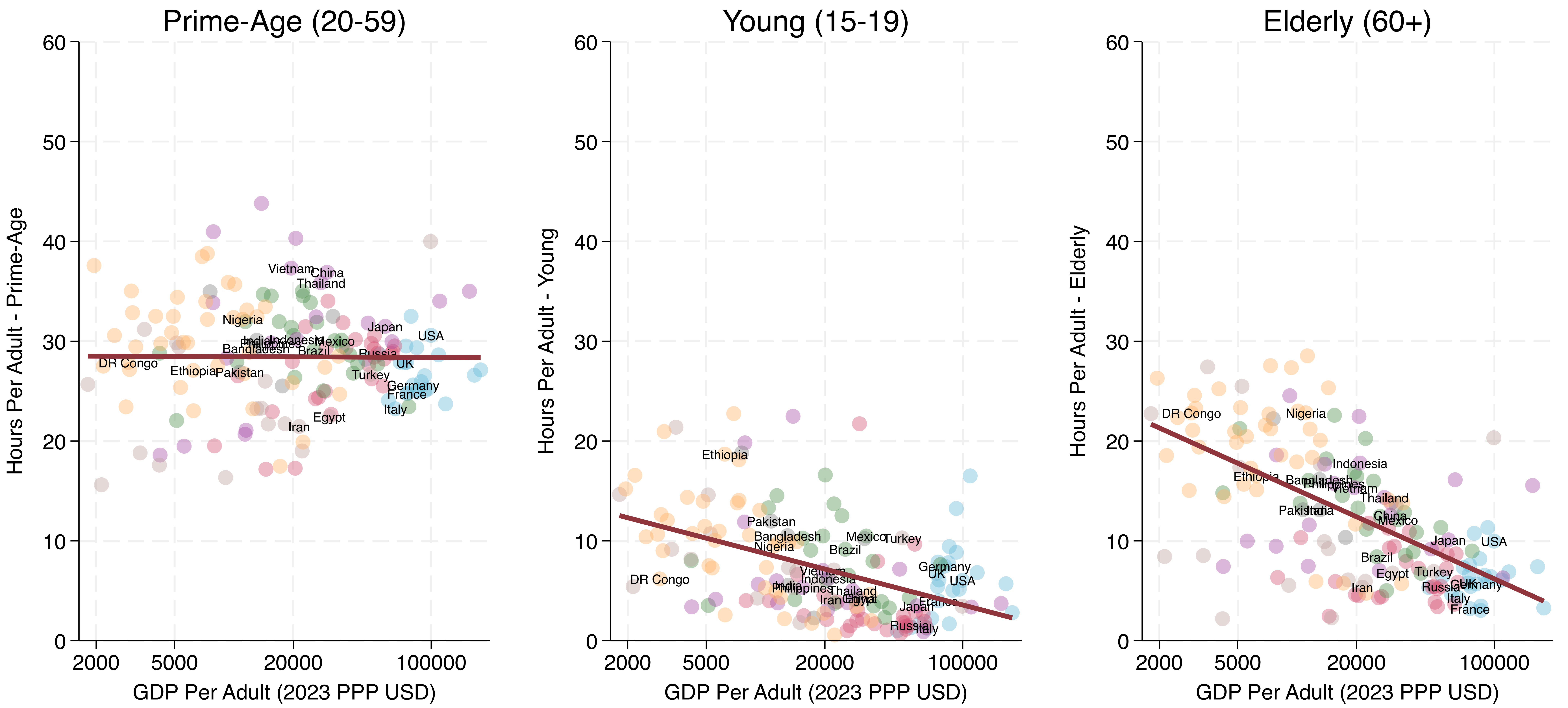
Data: Gethin and Saez (2026)

By Sector



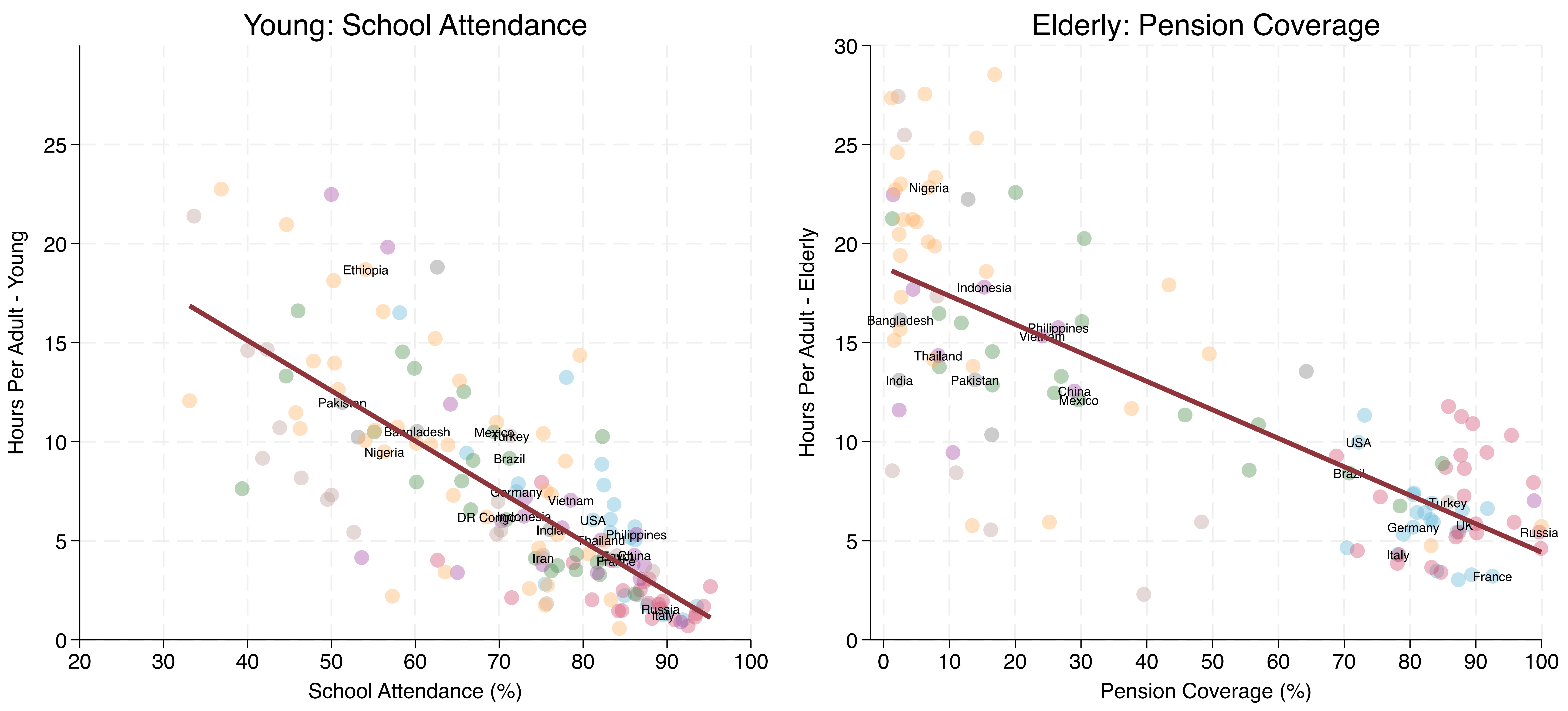
Data: Gethin and Saez (2026)

By Age Group



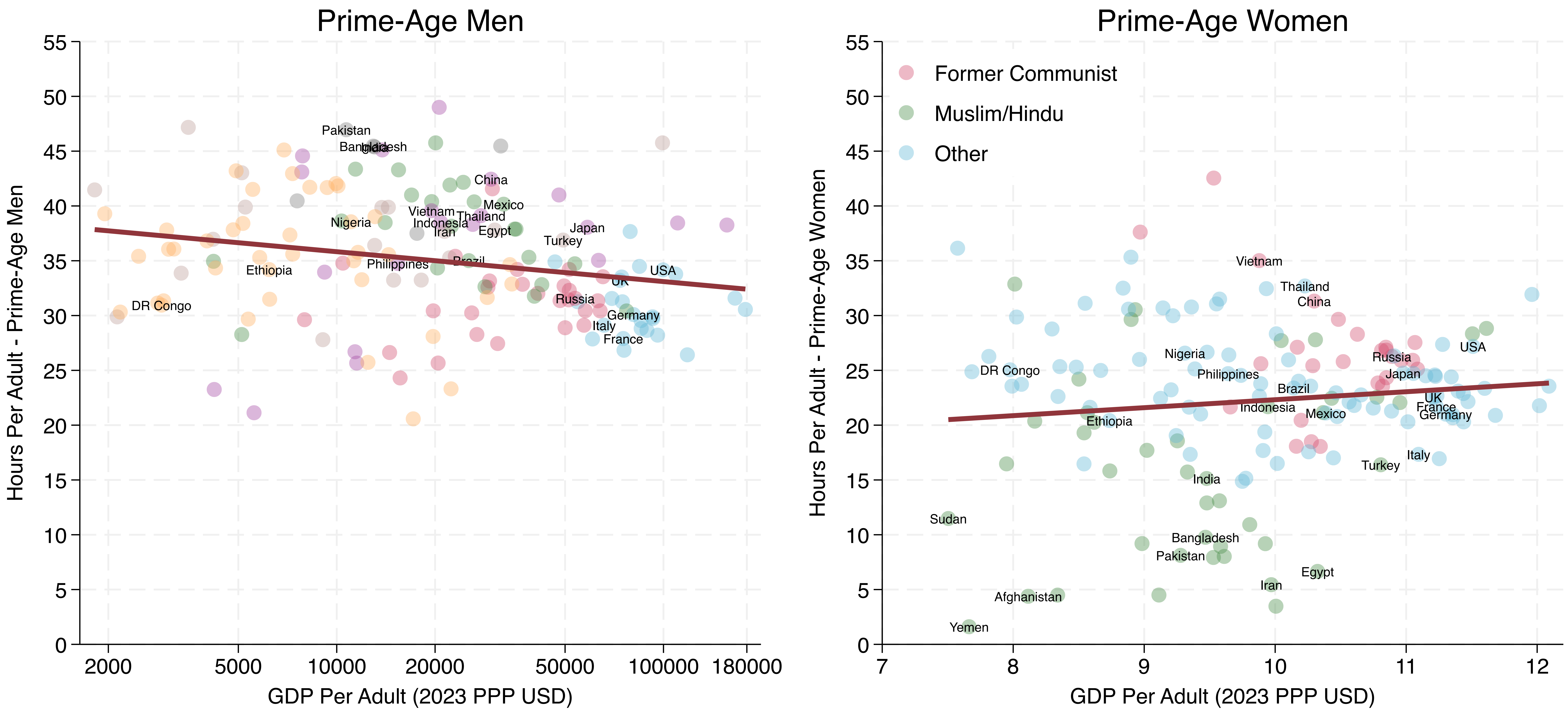
Data: Gethin and Saez (2026)

The Importance of Schooling and Pension



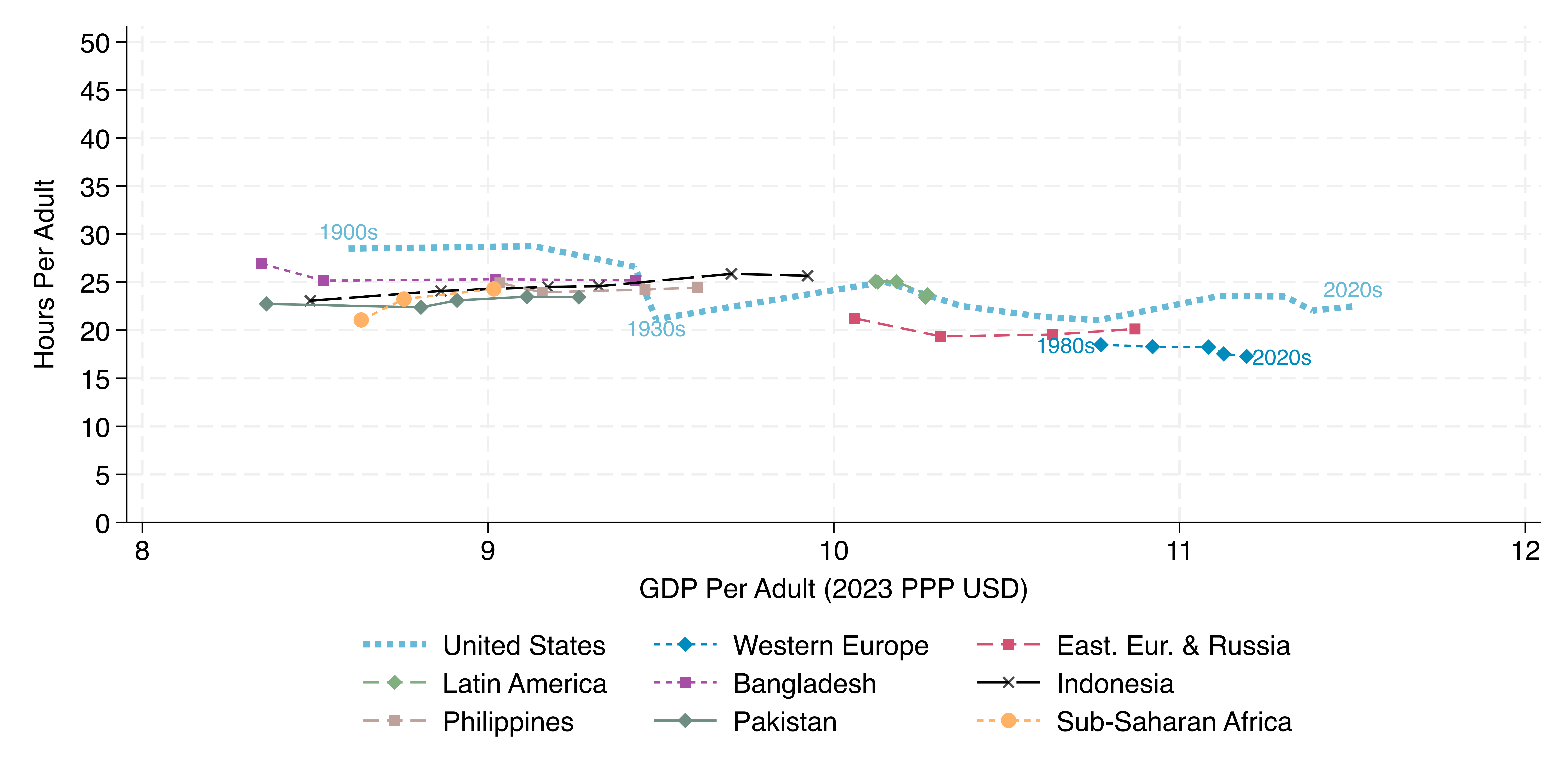
Data: Gethin and Saez (2026)

By Gender



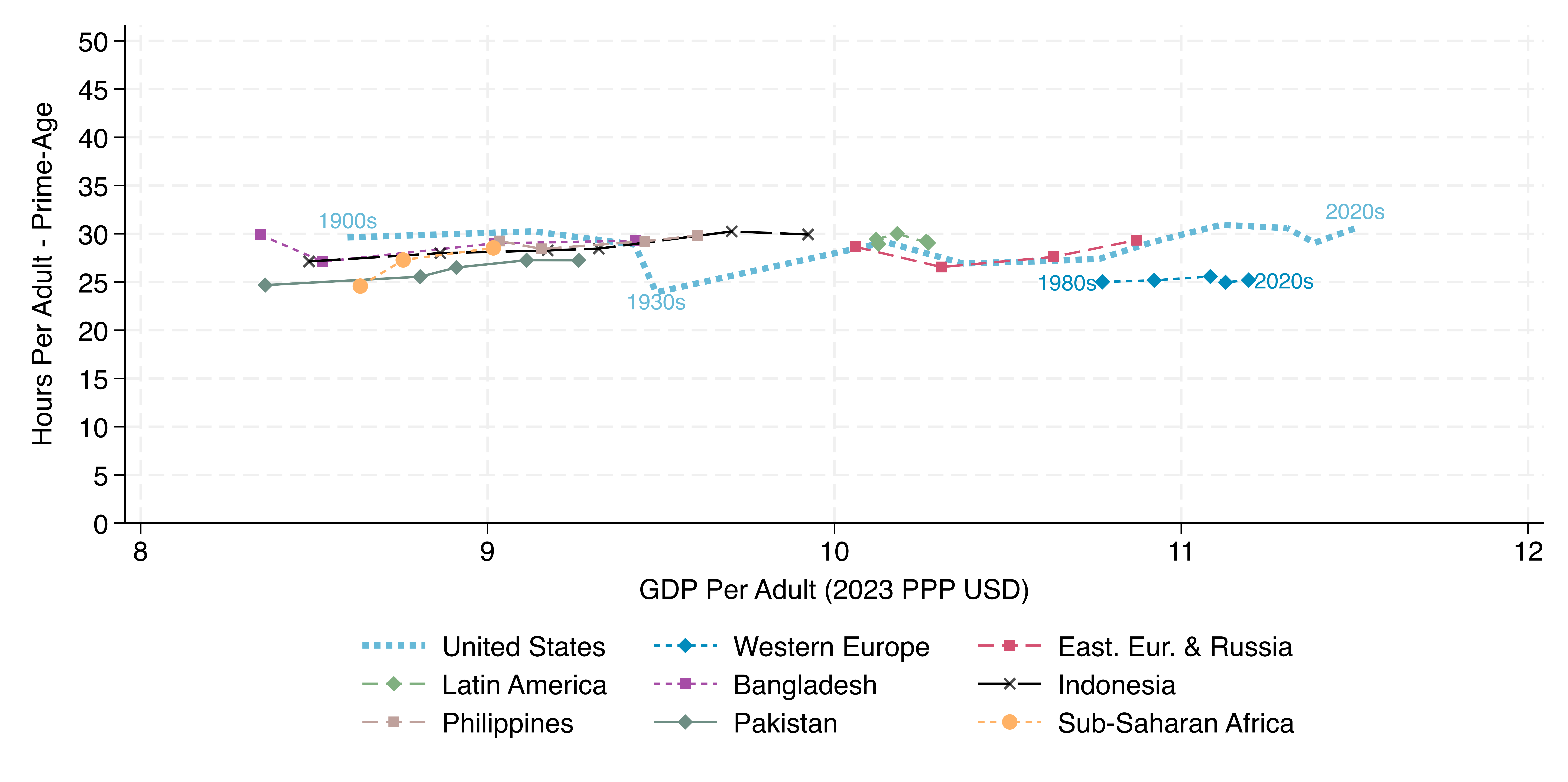
Data: Gethin and Saez (2026)

Over Time

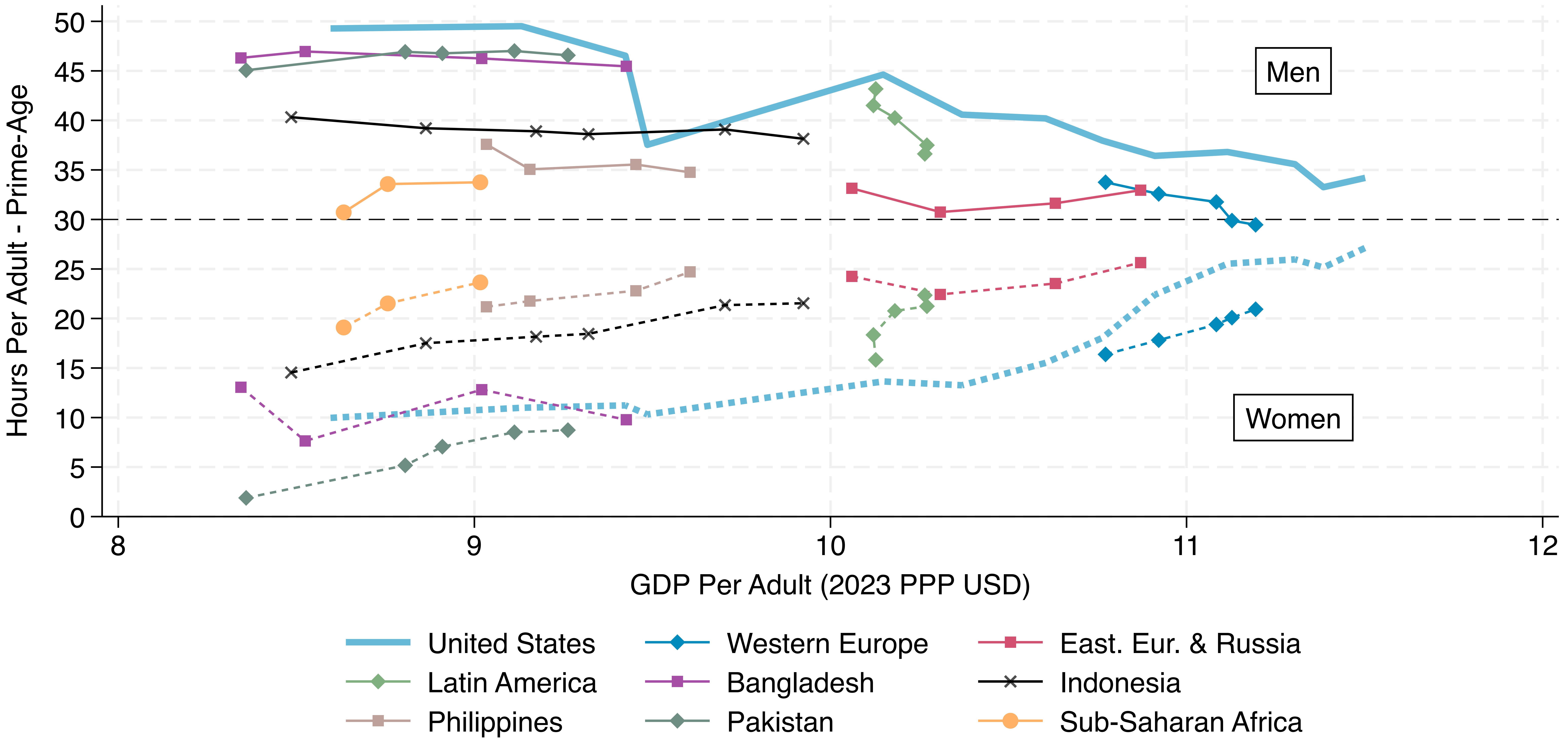


Hours Per Adult
50
45
40
35
30
25
20
15
10
5
0
8
9
10
11
12
GDP Per Adult (2023 PPP USD)
1900s
1930s
2020s
1980s
2020s
United States
Western Europe
East. Eur. & Russia
Latin America
Bangladesh
Indonesia
Philippines
Pakistan
Sub-Saharan Africa

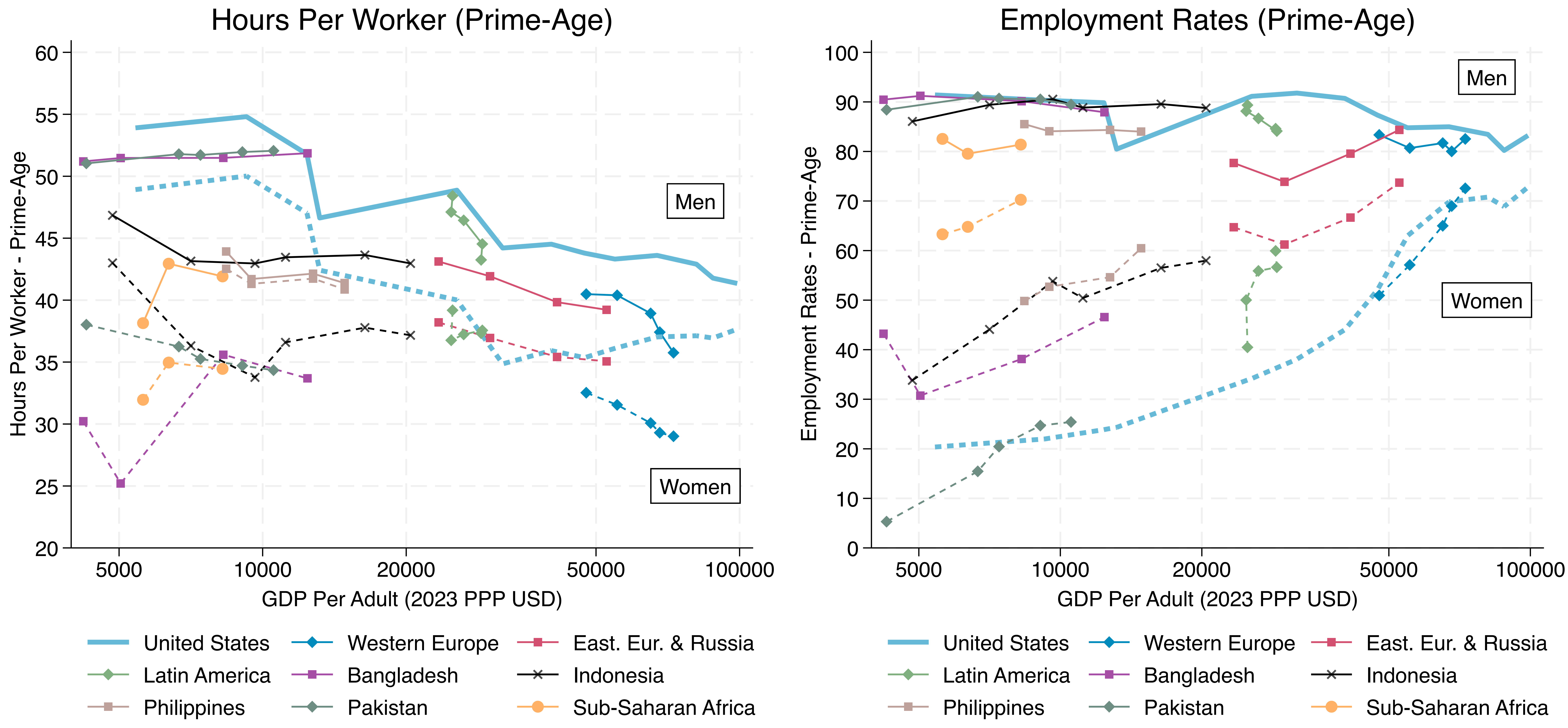
Prime Age (20-59)



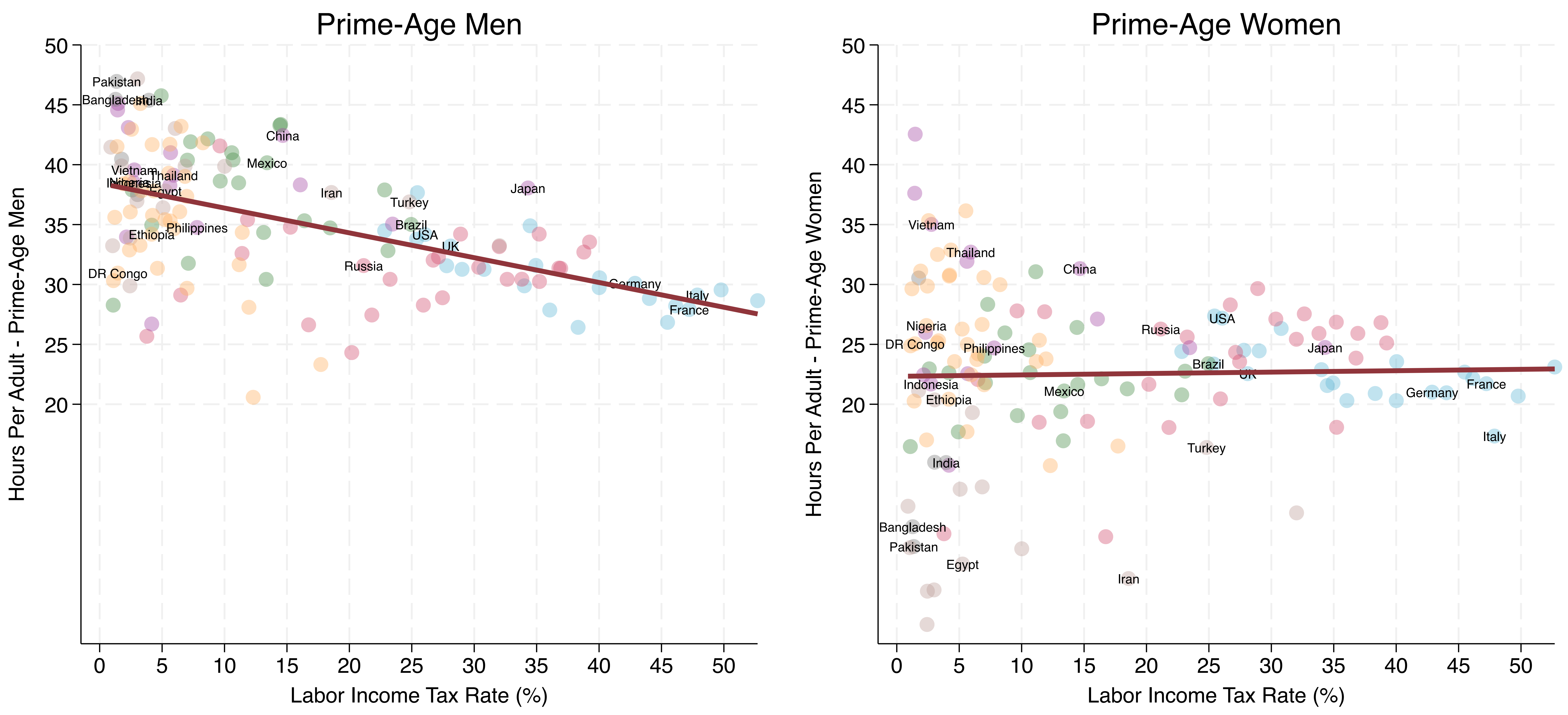
Prime Age by Gender



Hours per Worker vs. Employment



Role of Labor Income Tax



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