

ECOM181 Macroeconomics for Policy

2022/23 Semester 1

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What Determines Productivity?

Syverson, Chad. 2011

Journal of Economic Literature, 49 (2): 326-65

Accounting for Cross-Country Income Differences: Ten Years Later

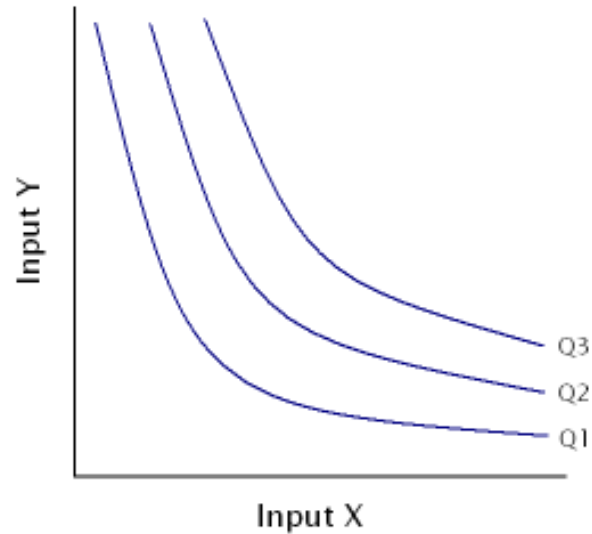
Francesco Caselli. 2016.

World Bank. World Development Report.

Plan for today

- What is Productivity
- How to measure Productivity
- Productivity differences across firms and countries

Isoquants of production function



- Along Q3 we have different combinations of labor and capital that lead to the same output
- Shifting to Q2 and Q1 implies that the same is produced with less inputs → Higher TFP
- Along Q3 (or Q2 or Q1) TFP is always the same
- Labor productivity (output per input x) can be increased with higher TFP (moving from Q3 to Q1) or by having more capital (increasing input y and moving along Q3)

What is total factor productivity?

- Given a Production function

$$Y_t = A_t F(K_t, L_t, M_t),$$

- Productivity is the residual that is necessary to explain how a certain amount of input factors could have resulted in observed output.

$$TFP_t = A_t = \frac{Y_t}{K_t^{\alpha_k} L_t^{\alpha_l} M_t^{\alpha_m}}.$$

- It is a measure of the efficiency with which inputs were used.

What is total factor productivity?

- Another way to approach this to construct a counterfactual output measure purely based on the inputs (assume only 2 inputs now)

$$\tilde{y}_i = k_i^\alpha h_i^{1-\alpha},$$

- And compare with the actually observed output.
- Based on the production function this again gives us productivity

$$y_i = A_i k_i^\alpha h_i^{1-\alpha},$$

Plan for today

- What is Productivity
- **How to measure Productivity**
- Productivity differences across firms and countries

Questions to discuss

- What are the difficulties of measuring productivity?
- Evaluate the strengths and weaknesses of using productivity measures to assess the performance of countries and firms.
- Do you think there are any general truths on what determines productivity dispersion observed in data?

Questions to discuss

- What are the difficulties of measuring productivity?

Measuring productivity

- Can measure at the firm level with micro production data
- Or at the country level with aggregate macro data
- In both cases measuring is based on a production function

$$Y_t = A_t F(K_t, L_t, M_t),$$

Measuring difficulties at the firm level

- Multiple products of a firm → Aggregate to 1 output measure?
- No measure of output available, only revenues
- What is labor? Number of employees? Hours worked? Quality-adjusted labor (wage bill)?
- Is measuring capital from firm's book value a good approximation of capital that was used in production? Maybe instead use investment and perpetual inventory method? Then what about depreciation?

Measuring difficulties at the firm level

- But even given these data, how to calibrate and use the production function?

$$TFP_t = A_t = \frac{Y_t}{K_t^{\alpha_k} L_t^{\alpha_l} M_t^{\alpha_m}}.$$

- Measure alpha's using expenditure shares? (assumes constant returns to scale)

Measuring difficulties at the firm level

- Alternatively, estimate coefficients in production function using a regression

$$\ln Y_t = \alpha_0 + \alpha_k \ln K_t + \alpha_l \ln L_t \\ + \alpha_m \ln M_t + \omega_t.$$

- But need to account for endogeneity (more productive firms might typically hire more labor)

Measuring difficulties at the firm level

- Conclusion: Many issues, and many assumptions need to be made
- But: usually very rich micro data sets so that findings are quite robust.

„high-productivity producers will tend to look efficient regardless of the specific way that their productivity is measured.”

Measuring difficulties at the macro level

- Base on per capita production function

$$y_i = A_i k_i^\alpha h_i^{1-\alpha}, \quad \tilde{y}_i = k_i^\alpha h_i^{1-\alpha},$$

- Need to measure (per capita) fiscal capital and human capital and calibrate alpha (the latter is set at 0.33 in the literature)
- Should natural capital (land, ores, etc.) be included in k?

Measuring difficulties at the macro level

- Calculate a measure of human capital based on observables that might influence it: schooling, health, cognitive skills

$$h_i = \exp(\beta_s s_i + \beta_r r_i + \beta_t t_i).$$

- But since we do not know h we cannot estimate this equation directly. Instead, calibrate it with within-country regression of wages:

$$\log(w_{ij}) = \alpha_i + \beta_s s_{ij} + \beta_r r_{ij} + \beta_t t_{ij},$$

Measuring difficulties at the macro level

- Use adult survival rate as measure of health?
 - Does not vary within country → But correlated with average height.
 - Measures health of future generation not of current work-force
- Test scores for cognitive skills not always available and not consistent at macro and micro level
- Should not calibrate beta's while leaving out a variable (omitted variable bias)
- Calibration of beta's based on regression can be quite different than conventional wisdom / existing macro literature

Plan for today

- What is Productivity
- How to measure Productivity
- **Productivity differences across firms and countries**

Productivity differences across firms

“90th percentile of the productivity distribution makes almost *twice* as much output with the *same measured inputs* as the 10th percentile Plant”

“even larger productivity differences in China and India, with average 90–10 TFP ratios over 5:1.”

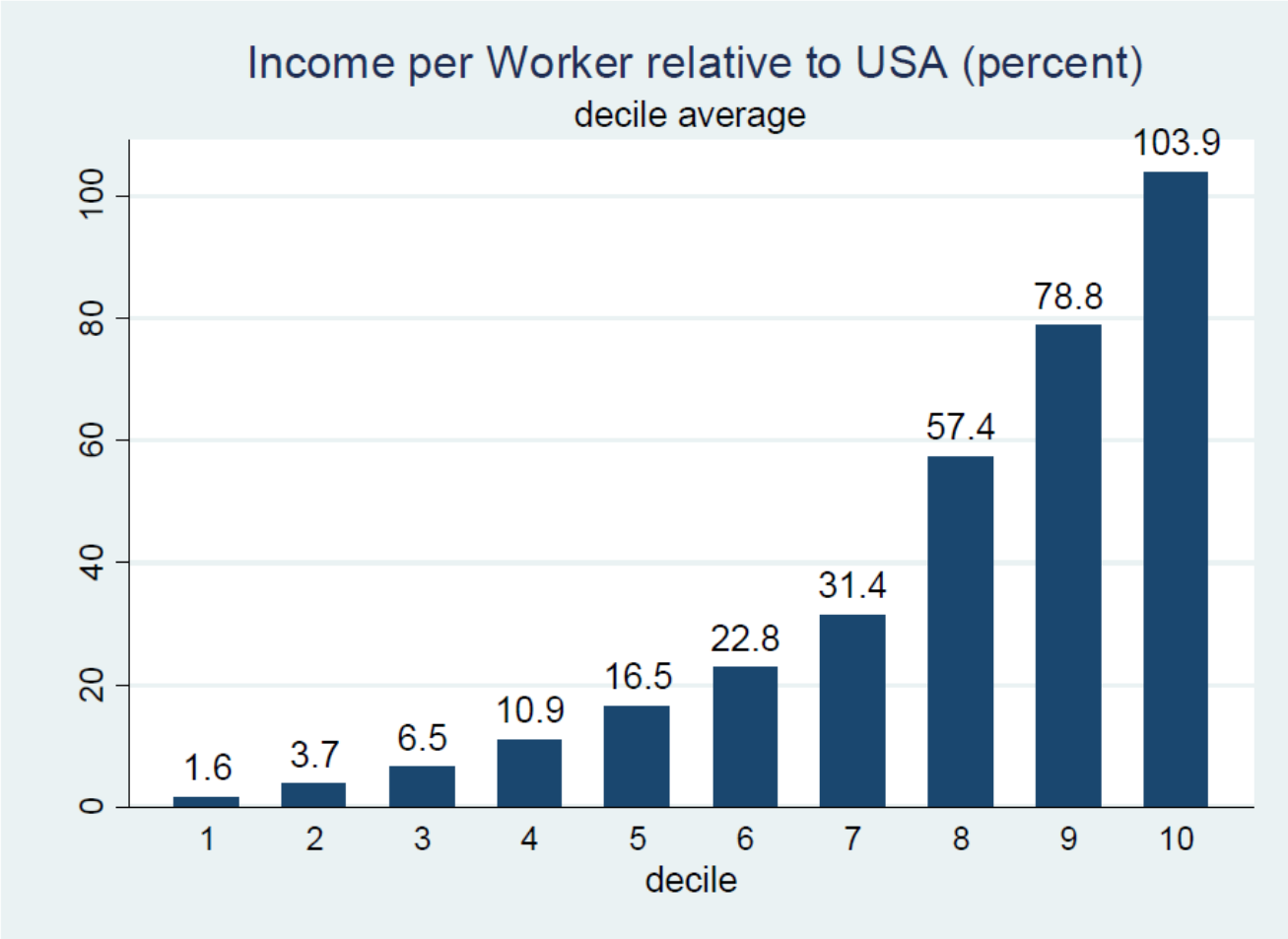
“Regressing a producer’s current TFP on its one-year lagged TFP yields autoregressive coefficients on the order of 0.6 to 0.8”

Productivity differences across firms

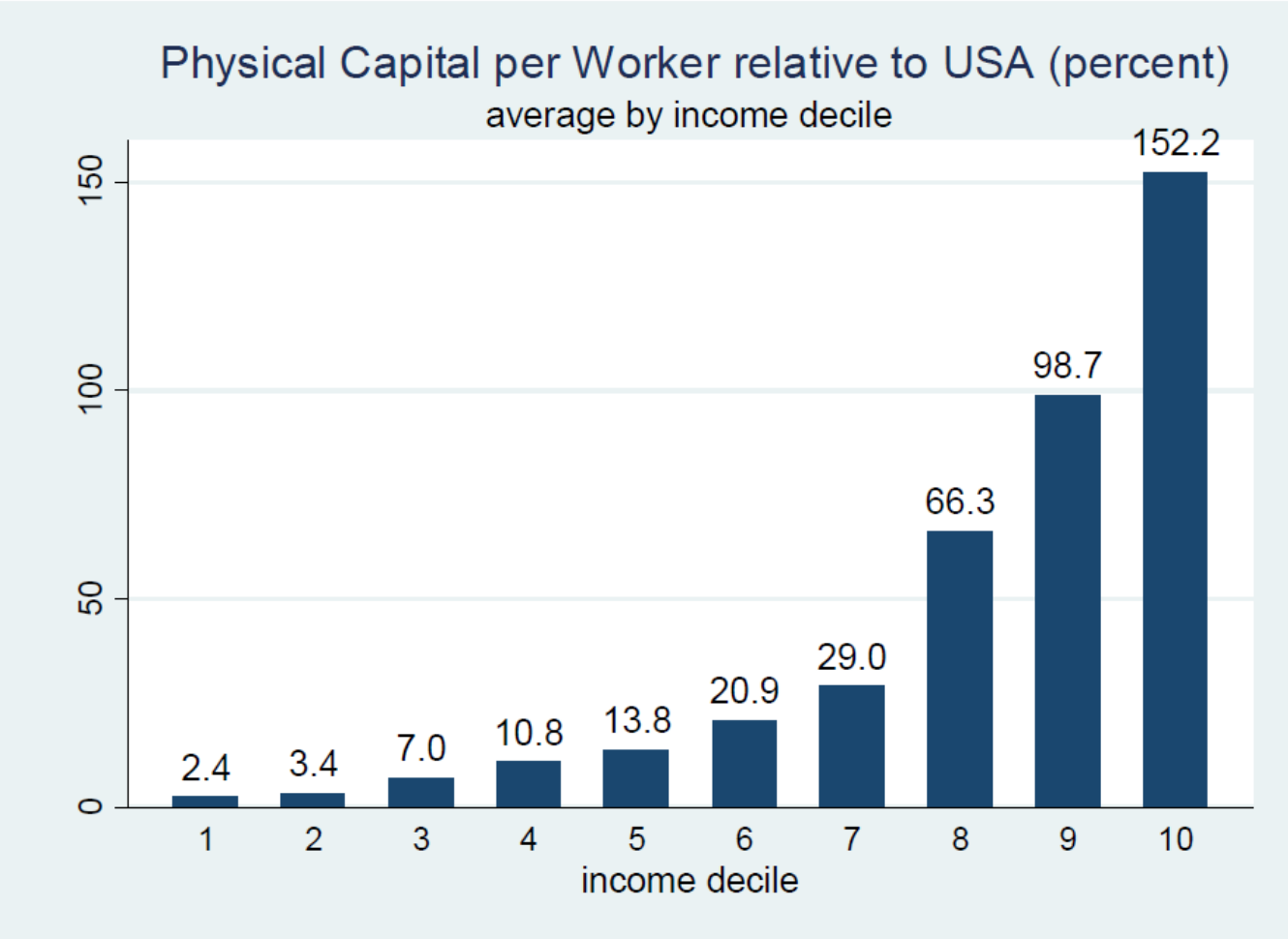
Differences can partly (but not fully!) be explained by

- Quality of Labor (measure with wage bill?)
- Quality of capital (E.g. how modern)
- Use of IT
- Investment in R&D and product innovation
- Learning-by-Doing

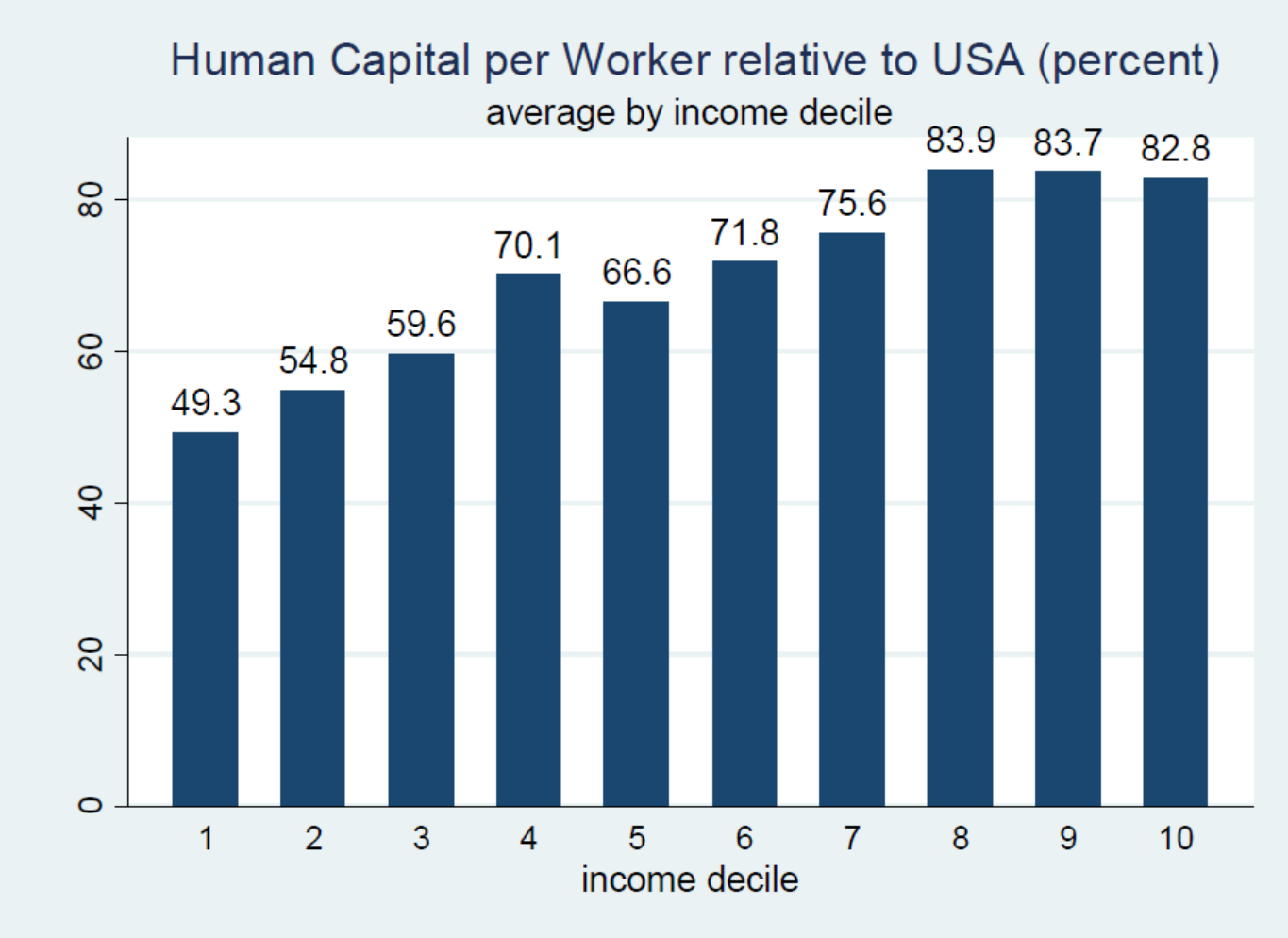
Income deciles of countries across the world



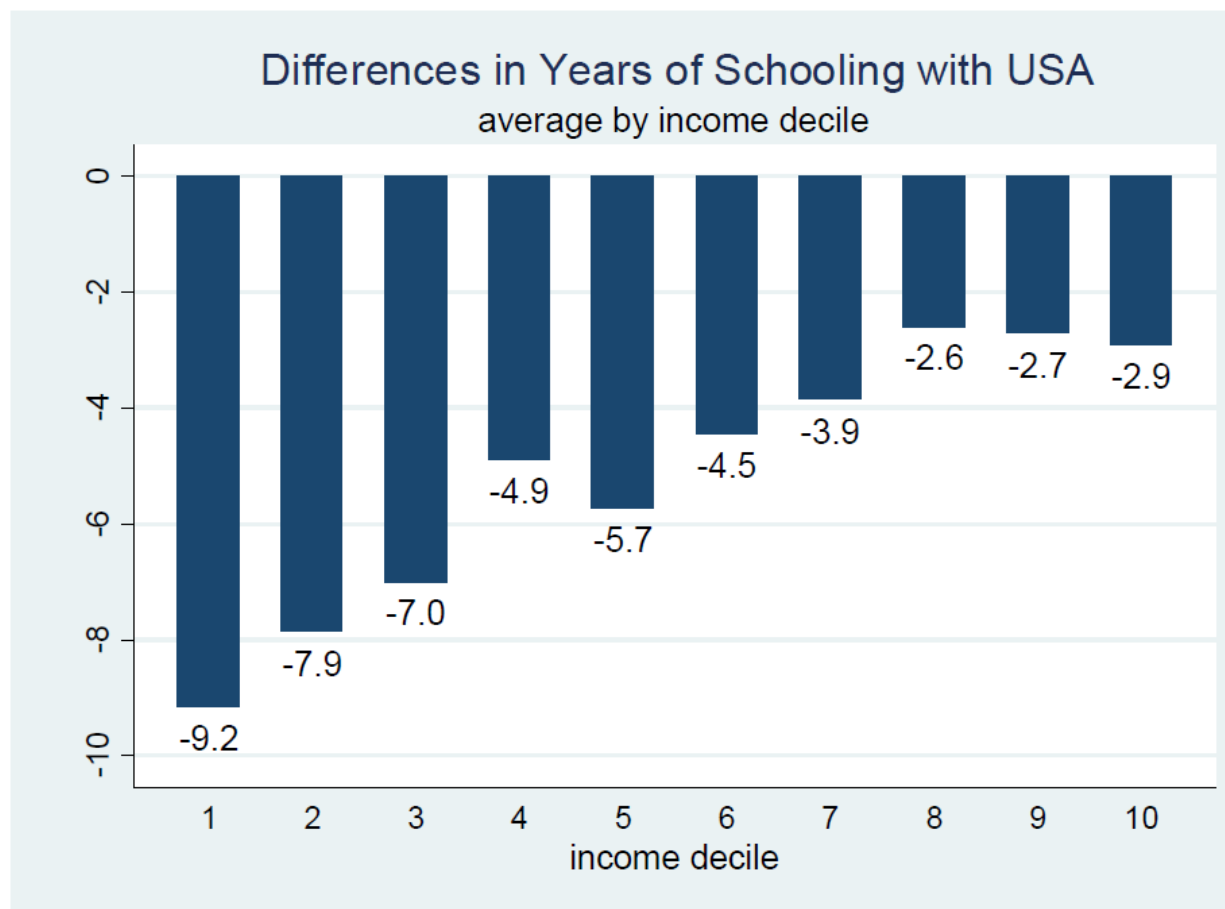
Same income deciles have also different physic. capital



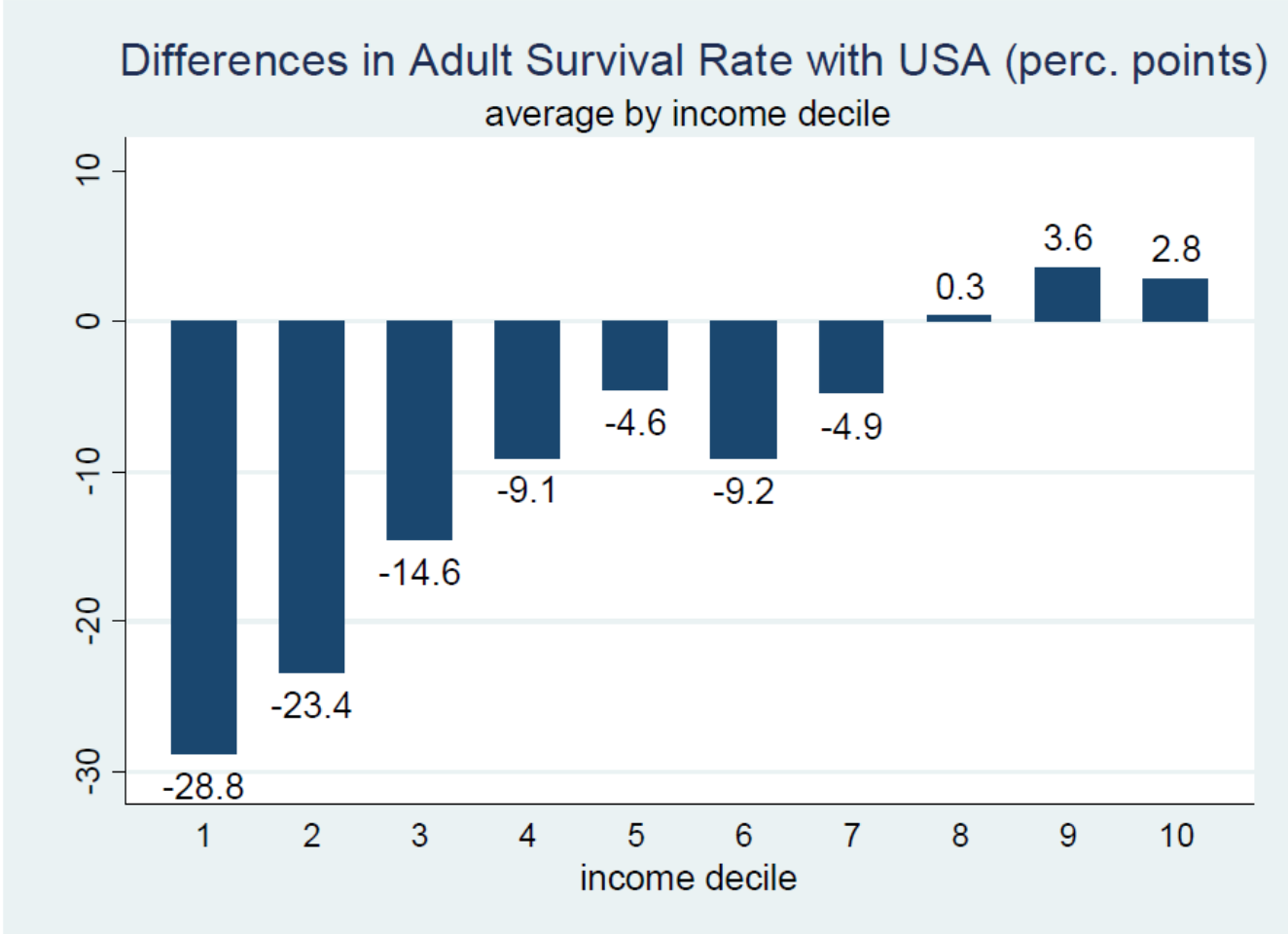
Same income deciles have also different human capital



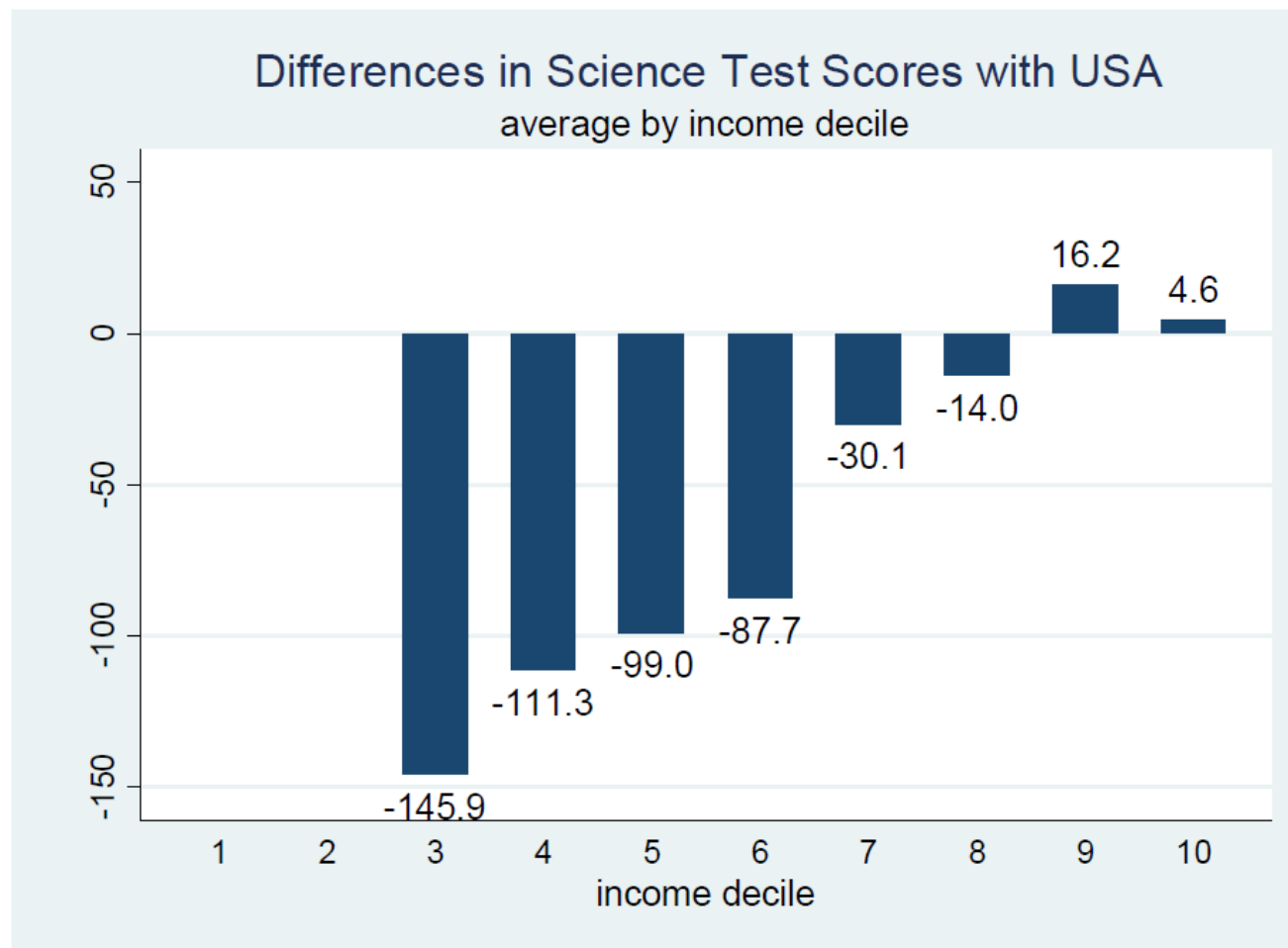
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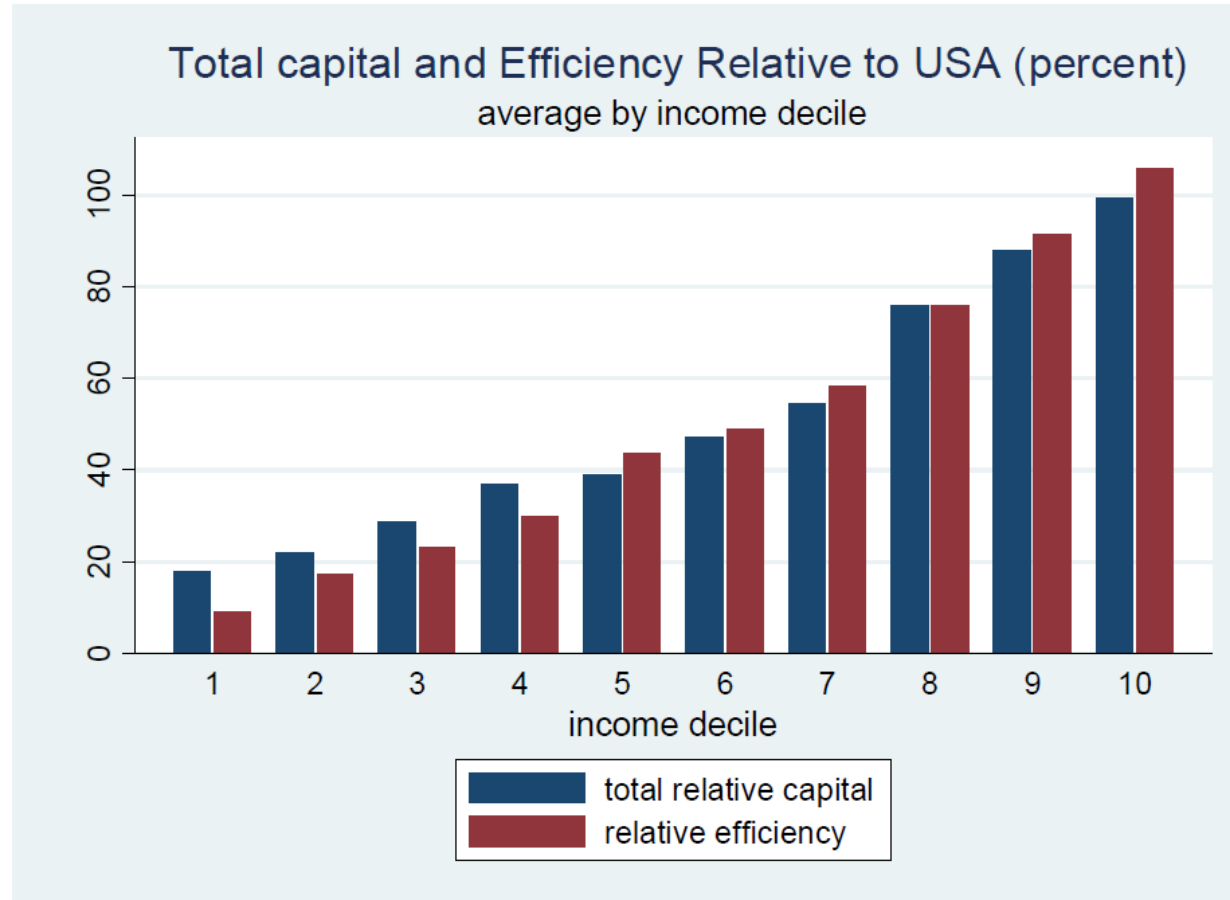
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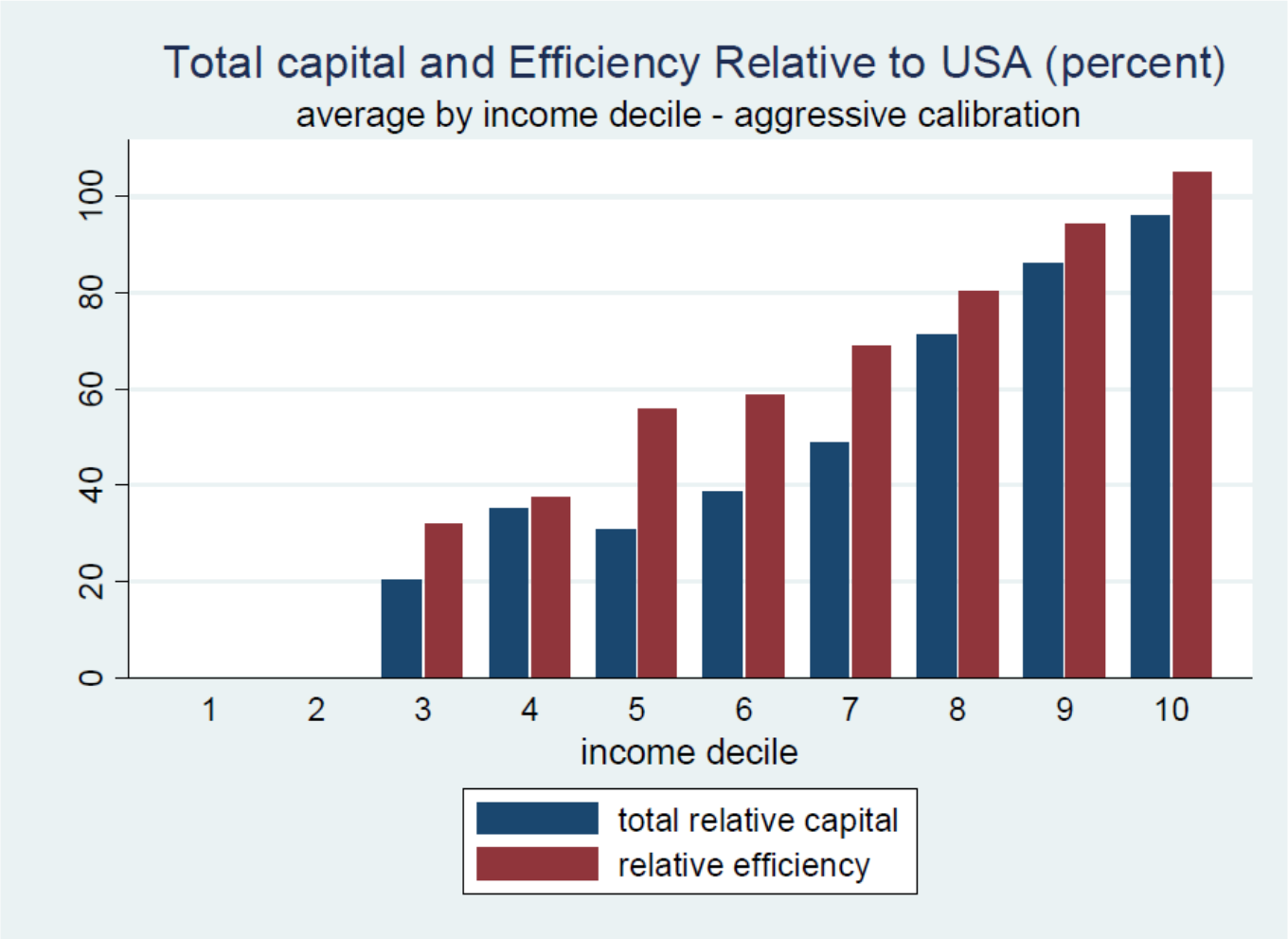
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Capital or efficiency gap? Both!



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